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30 June 1983

Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

No. 194

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SERIES REVIEWS STATUS OF NATION'S URANIUM INDUSTRY

Sydney THE SYDNEY MORNING HERALD in English 27, 29 Apr 83

[27 Apr 83 p 7]

[Article by Peter Freeman]

[Text] LIKE a bloodied boxer who keeps struggling to his feet to resume the fight, the Australian uranium industry doesn't seem to know when it's beaten. It just keeps fighting.

The latest body blow was Labor's victory at the March Federal election.

Already reeling from the impact of the world-wide recession, the slump in uranium prices, the dramatic scaling down in planned nuclear power station construction and strong opposition from environmentalists, the Labor win should have been the knockout punch.

Nine months ago, when Labor policy still called for the closure of existing uranium mines, it almost certainly would have been.

And there is no doubt that the change of Government makes the outlook for the local uranium industry less certain, a development underlined by Labor's decision to withdraw the negotiating licences under which uranium companies have been attempting to line up export contracts.

While the companies were told that they could reapply for licences, none has yet done so.

As well, there is the recent thumbs-down given by the South Australian Labor Government to the small Honeymoon uranium project.

But with last July's Labor Party conference having watered down the ALP's opposition to uranium, the industry has not written off all hope of being able to work with the new Government.

This hope has also been boosted by the toning down over the past two years of union opposition to uranium mining.

"Nothing is decided yet," says Mr Tony Grey, managing director of Pancontinental Mining and the industry's most vocal advocate. "The future is going to depend on how the Hawke Government administers Labor policy."

The company's giant Jabiluka deposit in the Northern Territory's rich Alligator River uranium region is still waiting to be mined after 12 years of lead-up work and has become a symbol of the Australian uranium industry's future — or lack of one.

While the company had hoped to start work at its site next month, it recently put this back to 1984 and laid off more than half of its small workforce.

Certainly, Pancontinental has the most to gain — and lose — from the twists and turns of Labor's approach to uranium.

The Government has set up a committee of four ministers to review Labor's uranium platform and turn it into Government policy. The committee is due to report at the end of June.

Asked about the new Government's policy on uranium mining, the Minister for Resources and Energy, Senator Peter Walsh, who is a member of the committee, was equivocal about whether any new uranium mines would be opened under Labor.

The only two mines in operation are Ranger and Narbalek, which essentially is a milling operation.

Senator Walsh declined to state absolutely that Pancontinental's Jabiluka uranium deposit would not be given an export licence.

While Labor's new policy permits the continued operation of the two mines, it does not appear to leave room for any new uranium mines, except for those where uranium was mined incidentally to other minerals.

This covers mines such as Western Mining's Roxby Downs operation, where uranium is found in association with a large deposit of copper, as well as some gold.

Asked if uranium mines such as Roxby Downs would be the only ones to be considered by the Labor Government for export licences, besides those already held by Ranger and Nabarlek, Senator Walsh said that any new licences would depend on watertight solutions being found to the key problems of nuclear waste disposal and nuclear arms proliferation.

Such solutions were unlikely before the end of the decade, he said.

Senator Walsh said the question of new uranium mines was largely hypothetical, since it would be at least six years before demand increased sufficiently to push up the uranium price to the minimum permitted by the Government for export contracts.

As with the previous Government, this is set at $US30 a pound.

According to Mr Grey, Pancontinental is more than happy to let market forces dictate uranium's future, because he is confident that contracts can be negotiated.

But Mr Grey says he is worried about the possibility of a foul blow, complete with a concealed knuckleduster.

"When contracts are signed and we are ready to go Labor might suddenly forget about economics and start citing environmental fears as a reason for withholding export licences," he said.

But the industry may go down anyway without this kind of knock-out punch.

Some analysts say privately that Mr Grey is too confident about negotiating contracts. They add that the economic downturn could put pressure on current uranium producers to renegotiate existing contracts.

After rising from $US6.50 a lb immediately before the 1973 oil price shock to a peak of $45 in 1978, the uranium spot price slumped to $17 in September, 1982. Since then uranium has recovered slightly and is now around $21.

However, the industry is at pains to stress that the spot price does not necessarily reflect the price of long-term contracts, where the question of reliable supply from diverse sources is a key consideration.

The only aspect of the Labor Government's approach to uranium which seems absolutely firm is its opposition to local nuclear power generation and enrichment plants.

The opposition to enrichment has resulted in the suspension of the work of the Uranium Enrichment Group of Australia (UEGA) pending discussions with the new Government.

The group, consisting of BHP, CSR, Western Mining and Peko-Wallsend, until recently was investigating possible sites for uranium enrichment.

Whatever the final approach to uranium adopted by Labor, the statistics for the Australian industry are impressive.

These show that Australia has the largest low cost uranium reserves of any western country — a total of 294,000 tonnes, excluding Roxby Downs, equivalent to almost 20 per cent of the west's known uranium reserves recoverable at below $US40 a pound.

Australian uranium production rose 50 per cent in 1982 to an annual output of 5,000 tonnes of yellowcake. The value of exports rose almost 80 per cent to $290 million.

From late 1977 until the end of last year the Federal Government approved contracts for the export of more than 44,000 tonnes of yellowcake valued at $3,500 million.

And while Senator Walsh appears confident that lack of contracts will slow the industry down, potential and existing uranium producers spent more than $32 million on exploration in 1981. Figures for 1982 are not yet available.

This is in line with the peak of $35 million in 1980 and is much greater than the $13 million a year spent in the mid-seventies, even allowing for inflation.

Yet even if the confidence of companies like Pancontinental is justified, they will still face the problem of getting an export licence from a Federal Government under pressure from environmentalists both within the Labor Party and outside.

According to Mr Leslie Kemeny, senior lecturer in nuclear engineering at the University of NSW and one of the designers of Britain's first nuclear reactor, any delays in granting licences could deal the Australian industry a fatal blow.

"Long-term contracts need to be signed quickly since technological advances, especially the development of fast breeder reactors, will greatly reduce uranium consumption after the year 2010," he said.

The latest environmental controversy centred on reports last September of a major fault in the nuclear waste dam at ERA's Ranger uranium mine.

One group strongly opposed to uranium mining is the Australian Democrats, whose leader, Senator Don Chipp, has likened Australia's selling uranium to the addict who pushes heroin.

Senator Chipp claims that safeguards against the possible misuse of Australian uranium for making nuclear weapons can never be watertight, a view which is also pushed by anti-uranium lobbyists, including such broad-based groups as the Australian Conservation Foundation and the Total Environment Centre.

Concern over nuclear weapons was highlighted in 1974 when India exploded an atomic bomb made from material supplied for peaceful purposes by Canada.

Like Senator Chipp, these environmental groups also argue that there is no existing solution to the problem of nuclear waste disposal and attack Japan for threatening to dump waste in the ocean.

But while opposed to uranium mining, both the Australian Democrats and environmental groups lack political clout — the former because its balance of power in the Senate counts for little given the Liberal-National pro-uranium stance; the latter because environmentalists are in disarray, at least on the uranium issue.

According to Mr Milo Dunphy, the director of Sydney's Total Environment Centre and a vice-president of the Australian Conservation Foundation, the anti-uranium movement had exhausted itself by the late seventies.

"Environmentalists generally needed a new cause to fight for and that was provided by the Franklin River," Mr Dunphy said. "That has taken up most of our attention recently, leaving little for anything else."

"A new co-ordinating body is needed. If this can be established and linked up with the current strong campaign for nuclear disarmament, the uranium mining issue will come back strongly."

Hopes are also partly pinned on the Franklin River campaigner Bob Brown redirecting his energy towards uranium mining once the Franklin battle is over.

For the badly bruised uranium industry, back-pedalling after 10 hard rounds, it would mean going back into the ring against a new and well-proven champion.

Other opponents of uranium mining claim that the proposed Koongarra mine should be the first to be cancelled, since it is in the Kakadu National Park.

But the Aboriginal community wants the mine to go ahead.

Mr Grey cites Pancontinental success in negotiating an agreement with the Aborigines at Jabiluka as a reason why that mine should proceed.

"Labor talks about giving some sort of self-determination to the Aborigines. If they stop Jabiluka, their words will sound pretty empty," he said.

Forecasts of weak demand are being used by the Labor Government to put off a decision, not only about Jabiluka but about the future of Australian uranium in general.

Defenders of nuclear power claim that the lowering of demand forecasts for uranium made in the mid-seventies merely reflects the overconfidence that initially gripped the industry after the November, 1973, OPEC oil shock.

"Predictions of likely nuclear power station construction were much too high," says Mr Leslie Kemeny of the University of NSW. "A downward revision was inevitable."

The nuclear power industry was also dealt a significant blow by the Three Mile Island accident in the US in March, 1979.

"As well, it needs to be remembered that the cancellation of proposed nuclear power plants in the US has been more than matched by cancellations of conventional power stations," Mr Kemeny said. "This has been due to the economic downturn of the past three or four years. When the US starts to recover, demand for energy will pick up strongly."

From the point of view of pollution, nuclear power supporters maintain that the closure of the conventional power plants should be applauded by environmentalists as being more beneficial than the cancellation of nuclear power plants.

"Coal is a vastly greater polluter and contains a greater long-term threat to the environment than nuclear energy," says Mr Kemeny.

Just how uncertain demand forecasts are is underlined by the varying estimates of nuclear power generation in 1985, 1990 and 2000

made by a range of expert bodies last year. They were the European Nuclear Energy Agency, the Organisation for Economic Co-operation and Development, the American Atomic Energy Commission, the Australian Atomic Energy Commission and the Uranium Institute.

The forecasts for 1985 range from 232 gigawatts of power up to 505; for 1990 from 361 to 1,265; and for 2000 from 585 to 2,800.

While this could lend weight to the Labor Government's view that lack of demand will defuse the uranium issue, it also helps explain why companies are prepared to push on with uranium development. If the high side estimates are even close the demand for uranium will grow strongly.

Certainly, Tony Grey isn't alone in claiming that demand is already picking up and will outrun supply by the late 1980s. This prediction is based on the assumption that many high-cost US mines will close, a trend which is already well under way.

Whether this trend will continue partly depends on how successful US industry lobbyists are in winning protection against uranium imports.

At this stage the first few rounds have gone against the protection lobby. If this continues it will provide the Australian uranium industry with new incentive to stay in the ring and fight for its long-term survival.

A lot of the increased demand will also come from Europe and Asia, including China, South Korea and the Philippines. These are the markets on which Australian's uranium hopefuls are focusing their attention.

In the case of Pancontinental, it has directed its efforts to securing contracts with British and European users.

But while Tony Grey has long claimed to have a contract to sell 150 million tonnes of uranium to Britain's Central Electricity Generating Board, Senator Walsh claimed earlier this week that that contract had been rejected by the previous Government because the price was too low.

Mr Grey says negotiations are well advanced with other potential purchasers of sufficient yellowcake to bring Jabiluka up to an output of 3,000 tonnes a year — the minimum needed to make it economically viable.

The Labor Government doubts whether these contracts will ever materialise.

Meanwhile, the search for new uranium deposits involves some of Australia's largest mining groups —CSR, MIM, Western Mining and CRA among others — as well as French, German and Japanese energy corporations.

The Japanese are involved through the Power Reactor and Nuclear Fuel Development Corporation of Japan — Donen — which hopes to participate in 10 new uranium projects in Australia and elsewhere in the 1990s.

The exploration effort in Australia contrasts sharply with that in the US, where the number of exploration holes drilled fell from 105,000 in 1977 to 59,800 in 1980 and 24,300 in 1981.

According to Mr Gordon Battey, an officer with the Bureau of Mineral Resources, the different exploration experiences of the US and Australia reflect the vastly greater cost effectiveness of exploring in Australia.

The exploration cost per pound of new uranium discovered in the US from 1966 to 1980 was $US1.60 compared to 34 cents in Australia, according to figures complied by Mr Battey.

While precise figures aren't available, new uranium deposits in Australia are also generally much cheaper to mine than those in the US, thus providing a further exploration incentive.

While Labor's rise to power federally will probably result in the scaling back of exploration in some of Australia's less promising areas, such as the Westmoreland prospect, it is unlikely to stop exploration in the rich Alligator River area.

As one industry analyst points out, exploration is geared to the very long term, when Labor policy may have been further diluted or, alternatively, the Liberals could be back in power.

For potential investors, the continued uncertainty over the future of nuclear energy means local uranium companies offer few avenues for profitable investment — with the possible exception of Energy Resources of Australia and its Ranger mine.

Since its formation in late 1981 to take over the Federal Governments' stake in Ranger and that of the other shareholders, ERA has made a net profit of $62 million.

The biggest beneficiaries of this have been the company's two main shareholders, Peko-Wallsend and EZ Industries, which were also the companies which discovered the deposit in 1969.

The high level of profitability of the Ranger mine contrasts sharply with the performance of Mary Kathleen Uranium, which last year paid its first dividend in 17 years — and then promptly closed down.

To date, investors in Pancontinental have suffered the same sort of financial battering. If export contracts and licences are not forthcoming, they, like the uranium hopes of the company, will almost certainly be counted out.

Since its formation in 1971 out of the Queensland hardware merchant Barker Holdings Ltd, the company has run up a string of losses.

Anyone who bought Pancon shares in 1976 at the top of the market would have paid $21 a share. Currently the price is $1.44, although once account is taken of bonus and right issues the price fall is much less. During that time the company did not pay a dividend.

Investors still wanting to buy into the uranium industry could possibly go through the side door and buy Western Mining shares.

Under existing Labor Party policy, WMC will almost certainly get approval to export uranium from its 51 per cent owned Roxby Downs copper-gold-uranium prospect in South Australia. The other 49 per cent is held by BP Australia Ltd.

Western Mining also has 75 per cent of the West Australian uranium deposit at Yeelirrie, although the decision by Esso in May last year to sell its 15 per cent cast doubt on the prospect's future, irrespective of Labor policy.

For some, Esso's decision to throw in the towel was symbolic, since in 1981 it all but pulled out of the Australian oil shale industry — an alternative energy source which is now out of the energy ring.

If the environmentalists move back into the anti-nuclear fight with renewed vigour, the Australian uranium industry will have to be fast on its feet to avoid a similar fate.

[Editor's Note: The second article in this three-part series deals with the nuclear industry in the United States and is therefore omitted here.]

[29 Apr 83 p 6]

[Article by Don Woolford]

[Text] THE OUTLOOK for uranium in Western Europe is enmeshed in a labyrinth of political pressures and economic uncertainties.

Political opposition to nuclear power generation has clouded the medium-term demand for uranium. The recession, over-production and stockpiling are further complications.

Despite the uncertainties, however, the future market for Australian uranium looks healthy — provided no significant changes are made by the new Australian Government.

The essential strength of the Australian position is that it is, with Canada, the lowest cost uranium producer at a time when, observers say, economic rationality points towards greater reliance on nuclear-based generation of electricity.

Australian sources in London say that one reason Australia was comparatively slow to win markets was the Australian Government's requirements which, in the late 1970s, were regarded as very stringent.

But by now buyers have become used to them and they have tended to become a model for some other producing countries.

Australia is now a significant seller to West Germany, Finland and Sweden and it may soon sign a contract with Britain. Germany has been the biggest success: on contracts signed to 1990 with German buyers, Australia is the biggest single source. Seven countries supply Germany and Australia has 38 per cent of the market.

This spreading of purchases over a number of countries is becoming more common, which is also likely to be to the advantage of Australian producers.

According to the French Atomic Energy Commission, in 1981 Australia was the seventh largest non-communist producer of uranium with 2,600 tonnes. By 1990, the commission estimates, its production capacity will be 4,700 tonnes, putting it in fifth place.

Ahead, in descending order, will be the United States (which produces mainly for domestic use), Niger, Canada and South Africa.

But a bigger question mark hangs over European demand. OECD figures show immense variations in demand over the short term.

The biggest growth in relative terms will be in Belgium, which in 1982 gained 30 per cent of its electricity from nuclear generation, which will rise to 62 per cent in 1985. France, rising from 50 to 59 per cent, will remain the biggest user in absolute terms. The other big increase will be in Spain, from 9 to 28 per cent.

On the other hand, Sweden and Switzerland will have only modest increases and Finland, another relatively nuclear-dependent country, will actually reduce its dependence by about 7 per cent.

But between now and 1985 is no time in nuclear forward planning. What happens to the end of the century is more important and less predictable.

For example, take Britain, which is likely to start buying Australian uranium. Britain has been buying from Canada and Namibia, but announced recently it would take no more from the south-west African country when its contract expires next year.

A spokesman for the British Central Electricity Generating Board (CEGB) said an understanding has been reached with Pancontinental Mining Ltd for uranium from Jabiluka.

Britain relies on uranium for about 12 per cent of its electricity and this figure will rise to 20 per cent in 1985. Further expansion is less certain.

In part this is because Britain is, by European standards, an efficient coal producer, which reduces the economic benefits of nuclear power generation, and the Coalminers' Union is a potent political force which, while it has so far failed to get its members' support for a general strike against mine closures, will bitterly oppose widespread closures.

One of the more cynical interpretations of the coal-nuclear equation is that the British Government uses the threat of greater use of nuclear power as a curb to the coalminers' demands.

Perhaps more importantly, there appears to be a lot of popular suspicion of anything nuclear. The Campaign for Nuclear Disarmament has enjoyed a remarkable resurgence recently and the Greenham peace women have gained enormous publicity. While these campaigns are directed against nuclear weapons, there has been a spillover against all things nuclear.

Matters may become a little clearer when a public inquiry into the CEGB's proposal to build a pressurised water reactor at Sizewell in Suffolk is completed. The inquiry opened in January and, a board spokesman said, may not finish until next year.

It will be hearing many objections based on environmental and safety concerns.

A recurring nightmare for proponents of greater use of nuclear power is that the Sizewell inquiry may become a model for stalling, if not destroying, future proposals. The Financial Times commented recently: "This inquiry will be protracted partly because so many bodies wish to participate, to gain experience for the public inquiry they expect when the CEGB declares plans for building a pressurised water reactor in their parish."

In France, however, a socialist Government has not significantly changed that country's program. But France, alone among EEC States, is itself a significant uranium producer and it also buys from Niger and Gabon, two African countries with which it has special trading relations.

Moreover, some Australian sources believe, the widespread opposition to France's nuclear weapons testing in the Pacific could, despite the fact that there is already a bilateral nuclear safeguards agreement between the two countries, make it difficult for Australia to sell to France.

Italy's plans are bogged down in mainly community opposition; Holland, the scene of many anti-nuclear demonstrations in recent years, has stopped all development; and Austria has voted in a referendum against any use of nuclear power.

While the details vary, similar political issues complicate the outlook in other European countries.

The new socialist Government in Spain has cut back its predecessor's plans for new plants. It will retain the four already in operation and complete the six in the most advanced stages of construction. But five others will be converted to coal use.

Additional uncertainties about the Spanish program concern the

poor performance of existing reactors and the difficulties in completing two others in the face of Basque separatist activity.

Furthermore, from Australia's point of view, Spain is not a signatory to the treaty of the non-proliferation of nuclear weapons, which is a prerequisite for the granting of an export licence.

On the other hand, Sweden, with three more reactors to be completed in the mid-1980s, has voted rather ambiguously to abandon nuclear power by 2010, which gives the industry there nearly three decades.

Sweden and Switzerland both also rely heavily on hydro-electric power. But Switzerland has already harnessed all its available hydro power and a proposal to exploit Sweden's last major source is caught up in a Franklin River-type opposition.

West Germany, Australia's best customer and another major target of anti-nuclear demonstrators, has resumed a reactor program that had been stalled since 1977. The recent re-election of a conservative government in Bonn is generally seen as good news for the program; and yet, typical of the complexities, the Greens, the country's main anti-nuclear group, also won their first parliamentary representation.

Even when objectors fail to prevent reactors going ahead, their activities force up the cost of going nuclear: not only through the cost and delays of Sizewell-type inquiries, but also by forcing extra safety measures on the operators.

The Financial Times has reported that safety factors account for nearly half the cost of new reactors in Belgium, compared with about 30 per cent in the mid-1970s.

Some observers believe the anti-nuclear groups are trying to force up the price of safety to the point where plants are no longer economic. High interest rates coincidentally help this strategy.

All this uncertainty obviously affects prices. So too have the recession, over-production, stockpiling and the increasing availability of comparatively cheap Australian and Canadian uranium on the market.

But a West German analyst, Dr Peter Bauder, has said that while the more publicised American spot market for uranium has fallen, the more important average long-term contract price has risen.

Australia sells all its uranium by long-term contract which, Dr Bauder said, in 1982, was on average about $A14 a pound higher than the spot market price, which was about $20.

Furthermore, most spot market selling involves stockpiled uranium. Dr Bauder argues that prices must rise as stockpiles are depleted and more low-cost uranium is tied up under long-term contract.

Another optimist is the chairman of the French Atomic Energy Commission, Dr Michel Pecqueur. He said recently that France's transfer to nuclear power will be "an economic trump card that I cannot believe the world will allow to escape."

This may sound a little hollow in the midst of President Mitterrand's hard new measures to rescue one of Europe's sicker economies.

Yet others agree with Dr Pecqueur. One London source said that electricity was the one area where, despite the recession, demand had increased and that in terms of cost, reliability of supplies and ease of storage, uranium was the most rational source of electricity.

Australian supplies were rich and reliable and its costs were competitive. "It is a natural in the market," the source said.

CSO: 5100/7531

ENERGY MINISTER SAYS PRICES ARE BAR TO NEW URANIUM MINES

Sydney THE SYDNEY MORNING HERALD in English 5 May 83 p 17

[Text]

CANBERRA. — No new uranium mines could be opened in Australia in the near future because of the slump in world prices, the Minister for Energy and Resources, Senator Walsh, said yesterday.

• "No new mines will be opened because nobody can sign a contract at a satisfactory price," he told the Senate.

• Senator Walsh said that while it was a matter for conjecture as to how long the depressed market conditions would remain, it was highly unlikely to change "in the first term of the Labor Government and probably unlikely to change in the second term.

• "The plain fact is that the state of the world market precludes any new mines from being opened under the policy of this Government or under the policy of the previous Government."

• Senator Walsh said that the previous Government had declined to approve a contract between Pan-Continental Mining and the British Central Electricity Generating Board because pricing arrangements were unsatisfactory.

• The present floor price for Australian export uranium contracts is about $35 a pound.

• Federal Cabinet is yet to determine how it will apply to the ALP's policy platform on uranium which prohibits the development of new uranium mines and provides for the phasing out of existing mines.

• The Government's attitude will determine whether there is any chance of the Koongarra and the Jabiluka deposits in the Northern Territory being developed in the 1980s.

• The Canadian company, Denison Mines is particularly keen to see its Koongarra deposit to fulfil existing contracts written in Canada.

CSO: 5100/7531

BRIEFS

COUNCIL'S STAND ON URANIUM--The chairman of the Northern Land Council at Darwin, Mr G. Blitner, has stated that the description "largely pro-uranium mining Northern Land Council" in an AAP report published in one edition of the HERALD on April 20 was not accurate. He said the council, a statutory body, carried out the wishes of the traditional owners. It acted against mining companies when so instructed. [Text] [Sydney THE SYDNEY MORNING HERALD in English 3 May 83 p 2]

CSO: 5100/7531

BRAZILIAN MILITARY CONCERNED OVER ARGENTINE TALKS WITH LIBYA

Brasilia CORREIO BRAZILIENSE in Portuguese 24 May 83 p 6

[Text] The delay in a solution of the diplomatic incident between Libya and Brazil that has already extended for more than a month is serving its principal objective: to prevent the cut-off of negotiations between the two countries in the area of arms and, principally, in the area of nuclear technology, a high government source confided to CORREIO BRAZILIENSE yesterday.

The solution for the problem of the planes and arms held in Brazil has already been adopted but it is reportedly dependent on a Libyan commitment that the four planes will not be diverted to Nicaragua, the sources revealed.

That solution, furthermore, the only one to which the Brazilian Government has not [as published] agreed from the outset, namely, the return of the war material to Tripoli in the same planes that brought it, has already been acknowledged to be the only possibility of reconciling relations with Libya.

Argentines

The problem of detaining the Libyan planes in Brazil is already worrying Brazilian military sectors in view of a new international development that has just arisen, which is the replacement of Brazil as a partner of the Libyans in military and nuclear cooperation agreements by the Argentines, who have already sent a 45-member mission to Tripoli.

That mission comprised of diplomats and top-level Argentine Government officials is returning the visit made to Buenos Aires by a Libyan delegation about a month ago, and for Brazilian military sources the possibility of success of negotiations in Tripoli is greater because of the hesitation shown by the Foreign Ministry in finding a solution for the impasse.

There is reliable information coming from those sources that the Argentines reportedly have a whole package prepared to furnish military equipment--TAM--type tanks--in addition to being able to establish a cooperation plan in the nuclear area, in view of the declared intention of the Libyans to replace the Soviet Union as their main supplier of technology in that field.

Since Brazil is hesitating, not only the Argentines feel free to enter that segment of the market that was already reserved for us: the Italians, builders of (Aeromacchi) fighter planes, have already submitted a bid to the Qadhdhafi government to supply 120 Pucara planes instead of those that were to be exported by the Brazilian Aeronautics Company (EMBRAER). The value of the Italian bid is $900 million, which gives an idea of the trade losses that Brazil is threatened with immediately because of the hesitiation of the Foreign Ministry.

Nuclear Agreement

The Brazilian military men who supplied this information stressed the fact that the real interest of the Argentine mission is not military but nuclear cooperation because the neighboring country urgently needs to export its leading technology as a means of entering the captive markets of American and European suppliers. The Libyans had assigned that function to Brazil, interested in exchanging experiences in the nuclear area, training their engineers here and developing reactors according to our technology already absorbed from the Germans.

That possible agreement of the Argentines with the Libyans is arousing apprehension among the Brazilian military because if Argentina succeeds in developing its technology, with the expansion of the markets for supplying their reactors, the atomic balance of the Southern Cone will be broken, with the Argentines surpassing Brazil.

8711
CSO: 3342/121

CASTRO MADERO ON NUCLEAR PROJECTS, DEVELOPMENT

Buenos Aires SIETE DIAS in Spanish 10-16 May 83 pp 24-30

[Interview with Carlos Castro Madero by Osvaldo Leboso; date and place not specified]

[Excerpts] A Surprising Consistency

[Question] In today's Argentina, in which it is hard for most government officials to last any length of time in their jobs, you seem to be a sort of oasis. I would like you to explain the causes of this consistency.

[Answer] If that is a personal question, it is very hard for me to explain. If you are asking me why, for the past 7 years---that is hard to say. What I can say is that ever since the CNEA [National Atomic Energy Commission] was founded, it has had continuity and great consistency in its actions, for a number of reasons. A primary factor is that its chairmen have preserved the institution from the nation's political upheavals. This means that staff hiring and continued employment have never been linked to political problems. Secondly, the chairmen of the CNEA have maintained the same central policy: self-sufficiency in the nuclear field. And the fact that the institution has had very few chairman has helped us to avoid any deviation.

[Question] Could you talk about this consistency, but in the nuclear plan. Does that sort of continuity exist, and how has it developed over the past 7 years?

[Answer] Throughout the 30 years of the Commission's existence, it has set objectives and policies in the nuclear field in a consistent and steady manner. These objectives were approved by the Military Junta in 1977. One point clearly defined was the need to achieve the maximum level of nuclear self-sufficiency. The main point of continuity in this plan is the need for the

two areas of the private sector involved to have security in order to act. These areas of the private sector are industry and engineering. For this reason, the nuclear plan was defined in 1979. Thus it was established in February of that year, that from that time until 1997 Argentina would build four nuclear power plants in addition to Atucha I and Embalse (opened a week ago). The first plant was to be Atucha II which will begin operating in 1987; the second will open in 1991, the third in 1994 or 1995, and the fourth in 1997.

For this reason I will say that the nuclear plan is designed in a realistic manner, and is suited to Argentina's needs. The years separating one plant from the next will keep us from saturating Argentina's power of response, which could otherwise force us to turn to foreign assistance, which would not be desirable. And in addition to these four plants, another important development is the fact that this year the construction of facilities to provide fuel (uranium) and heavy water was approved.

The Argentine Atom Bomb

[Question] I am surprised that in this country, where the government oscillates between a pure pro-western stance and the non-aligned movement, without any clear definition, that nuclear energy could be so independent, to the point of rejecting pressures from foreign powers.

[Answer] The explanation is found in a point that I left out when we were speaking of the consistency and continuity of our nuclear policy. The Commission is responsible for everything related to nuclear energy. Therefore, the chairman of the Commission acts as an extraordinary and plenipotentiary ambassador to the International Atomic Energy Agency. The Commission also has the primary responsibility for providing advice on matters related to international nuclear policy. Now I don't mean that the foreign relations ministry has nothing to do with this. But in reality the Commission has conducted our international relations in this area. Because, even though the ministry of foreign relations is responsible, its primary adviser is the National Atomic Energy Commission.

[Question] It is quite obvious that our country's economy has not been working very well in recent years. Could you tell us the cost of the nuclear plan?

[Answer] When Argentina's nuclear plan was drawn up, an evaluation was made, taking into account the funds it would produce, as our nuclear power plants began to generate electricity. In 1979 the costs until 1997 were estimated at about $6

billion in net investment costs. With interest, that figure would rise to $9.6 billion by the final year of the plan. That would be covered with the recovery of electricity, for which there would be a 60 percent rate hike until 1997. By 2005, it is assumed that capital recovery will exceed the cost.

[Question] One very specific question: is Argentina building an atom bomb or not?

[Answer] No. Argentina has repeatedly stated that its applications of nuclear energy are devoted solely to our national development: to improving the well-being and health of our people. In addition, one of our objectives in international policy is to try to integrate Latin America. If a Latin American country were to develop a nuclear weapon, that would create great fear, and lack of confidence. And that would work in the opposite direction. It would lead to disintegration, and not just that, it would also unleash an arms race. No country wants to be inferior to its neighbors, so other countries would earmark large amounts of human and economic resources that are needed elsewhere. That would cause damage that would worsen the problems of underdevelopment we have on this continent, problems which we are now trying to combat by using nuclear energy.

[Question] I agree with you about the peaceful use of nuclear energy. But what would happen if our country did decide to build a bomb? What would be the reaction of Germany, the United States, Great Britain, and the Soviet Union, in such a case?

[Answer] There can be no doubt that their reactions would be totally negative. They would, in all security, impose harsh restrictions on the transfer of nuclear technology. And that would seriously affect our program for peaceful purposes. I believe that the greatest damage they could do to us would be to cut off technological assistance, because that would harm the economy and the integral development of Argentina. I don't want to even think about the other serious steps that those industrialized nations might take.

[Question] That would be the "external cost." But what would it cost Argentina to build an atom bomb?

[Answer] It is hard to give you a figure. We would need to have a feasibility study done to determine the real costs of that development. I believe it would be in the range of thousands of dollars, but it is impossible to quote an exact figure. That would require a preliminary study and the analysis of several hypotheses.

A Nuclear Submarine?

[Question] Sir, after the war against Great Britain, the idea of using nuclear energy for military purposes resurfaced once again. What is Argentina's position on this?

[Answer] I would say that the only change, after last year's conflict, was the possibility of using nuclear energy to power ships. This conflict did not at all alter the idea of not developing nuclear bombs. But what we did find was what we consider to be unfair treatment in the international arena. For Argentina understood that nuclear propulsion was also a form of nuclear activity like any other, and for that reason, it was not to be used in military conflicts. My presentations to the International Atomic Energy Agency revealed that Argentina's position was not shared by other parties. There is a difference: they are concerned solely about the development of nuclear explosives. But they are not concerned about the use of submarines with nuclear propulsion systems.

[Question] And will a nuclear submarine be built in Argentina?

[Answer] Look. In this situation it is the CNEA's understanding that our country should have the same right to develop nuclear propulsion systems. For this reason, the Commission has begun a feasibility study on the possible use of nuclear propulsion with the submarines it now has under construction. This does not mean that a nuclear submarine is being built now, or that there is a project to build one in the future, but simply that this study is being done to determine whether or not we have the capability of building a power plant, a reactor to be used for propulsion, and at the same time, to determine the cost and time of construction. It is completely true that no decision has been made at all about any plan to build a nuclear submarine. We must remember that this project is of such magnitude, and requires such large investments and continuity, that the decision will have to be made by the new constitutional government or by future governments, but not by the present government.

[Question] Could you discuss the cost of such a submarine?

[Answer] When the study is completed, I believe it will show that it will cost hundreds of millions of dollars. But that is just an estimate. The cost might be quite different. But let me repeat, I could answer that more precisely once the study is finished.

[Question] You are talking to me about hundreds of thousands of dollars, and Argentina has a horrible foreign debt. That is why energy development seems to be like a nuclear elephant opposing a social mouse, which is the rest of the country. How is this perceived politically?

[Answer] Don't tell me an elephant is a negative thing!

[Question] I mentioned an elephant in order to represent the magnitude of nuclear energy development in relation to our backward social development.

[Answer] I believe that culturally and scientifically Argentina is a developed country. Now I will come back to the issue we touched on earlier, about consistency and continuity. I think that if the Argentine people devote themselves to a specific issue and are given adequate resources, they will be able to do the same work as more advanced countries. An example of this is the nuclear plan. There are no miracles. The truth is that a group of highly skilled Argentines joined this institution; there has been continuity and consistency in their objectives, and they have been backed by all the governments that have come and gone. By this I mean to say that, in such conditions, the Argentine is no less capable than any other of the earth's inhabitants.

The Falklands and a Nuclear Base

[Question] I would like to go back to the issue of war. It is being stated publicly that Great Britain has nuclear weapons in the Falklands and that it may be preparing to transform the Falklands into the much discussed South Atlantic nuclear base. What is Argentina's reaction to that?

[Answer] Given such a possibility, appeals would be made in all appropriate diplomatic forums. For if that were true, it would be in violation of the Treaty of Tlatelolco which Great Britain signed, governing the installation of nuclear weapons.

[Question] What are the provisions of that treaty?

[Answer] It covers the denuclearization of Latin America. All the Latin American countries pledged not only not to develop, but also not to receive nuclear weapons, even weapons being sent elsewhere. Nor can these weapons be stored in Latin America. In addition, there are two protocols which form part of the treaty. In the first protocol, the countries which have either de jure or de facto possessions in the area pledged to respect the

treaty. Great Britain does have de facto territories in the Latin American continent and in the area covered by the treaty. For this reason, and as it signed the treaty, it did pledge not to introduce nuclear weapons and not to use nuclear energy for military purposes. If it did so it would be a flagrant violation of a treaty which it signed voluntarily.

In addition, the second protocol says that the five powers which possess nuclear weapons are obliged not to attack or threaten any of the Latin American countries.

[Question] It does occur to me, based on our experience during the recent war, that Great Britain would have no problem about violating international legislation, as it has already done. In that case, what would Argentina's reaction be, beyond a possible international protest?

[Answer] I believe you are asking whether our policy might be changed. But it is necessary to make it clear that it would not just be a protest, but that we would carry out a sustained action to force Great Britain to remove any nuclear weapons from the Falklands. And I am absolutely certain that such an action by Argentina would be supported by the great majority of nations. Especially because the delicate nuclear equilibrium would be placed in very serious danger, and I believe that the first one who realizes perfectly clearly that it would not be supported by the rest of the world is Great Britain.

[Question] You are convinced that the same thing that happened with the TIAR [Inter-American Reciprocal Assistance Treaty] would not be repeated?

[Answer] Yes, I firmly believe that Great Britain could not withstand the pressure from the rest of the world if it decided to install a nuclear base in the Falklands.

[Question] What if the United States supported Great Britain, as has happened in the past?

[Answer] I am absolutely convinced that if there is one country that is not interested in that sort of intervention, it is the United States. That country has been a leader in working out policies to avoid nuclear proliferation, and through its diplomatic activities, it has managed to attract a great deal of support for nonproliferation. That is why I believe it would not be inclined to lose this consensus, because of a unilateral

action taken by Great Britain. An action of that sort would really place the entire delicate balance in a state of crisis, and Russia and the United States have the most at stake in this situation.

[Question] The fact is, Vice Admiral, that the United States has already supported Great Britain, and that the topic of NATO's nuclear base in the South Atlantic has been coming up for years in talks about geopolitics.

[Answer] I believe that we are getting involved in an issue that is separate from the specifically nuclear issue. They are related, but I am not the most appropriate person to express an opinion on this. In essence, I can tell you that an equilibrium has been achieved within the nuclear nonproliferation policy. The advocates of this policy have been the United States and Russia. For that reason I believe that the two great powers will go to great lengths to preserve this equilibrium, which would be endangered if the presence of nuclear weapons in the Falklands were to be tolerated.

Nuclear Colonialism and Technology Exports

[Question] You have spoken of nuclear colonialism. Can you explain what that consists of?

[Answer] What I call nuclear colonialism is in reality a form of technological colonialism. This means that the developed countries really exercise this colonialism because they continue to transfer out-of-date technology. Then the recipient countries are forced to turn to them for newer technologies and related services. This becomes a vicious circle, in which the more developed countries maintain a sufficient distance so that the developing nations can never manage to catch up with them. In the nuclear field, behind this policy of nonproliferation, there are concealed interests which want to maintain their industrial and technological hegemony. For that reason, the industrialized countries establish agreements among themselves to consider certain restrictions on technology transfers and on some which are called "sensitive." All this is done in the name of avoiding a nuclear holocaust, but in itself it constitutes an impediment, preventing countries like Argentina from becoming truly self-sufficient in their development.

[Question] And what is our country doing to try to escape from this vicious circle?

[Answer] Argentina must develop its own technology, and it is not going to accept any sort of restriction on the development

and application of all technologies. When we speak of "sensitive areas," we are referring to the reprocessing of certain types of fuel elements, to the production of heavy water, and to plutonium and the technologies related to its enrichment. It is easy to see that Argentina is not going to be bound by such restrictions, since it has a heavy water plant now being built. It also has a pilot plant for developing its own technology, and studies are being done on using plutonium in fuel elements.

[Question] But for the time being, Argentine technology is still in a state of dependence. How long will that be the case?

[Answer] We are continuing to catch up, in order to emerge from this dependence. Our goal is that, for the construction of the fourth power plant of the nuclear plan, in 1997, we should be able to use technology developed here.

[Question] Last week the second nuclear plant was opened, at Rio Tercero, Cordoba. What benefits will it have for Argentina?

[Answer] The Embalse Nuclear Power Plant will provide 600 MW to the electric power system. It is a highly reliable plant, so we can expect it to spend little time out of service. It has also greatly helped to raise the level of quality of our national industry, since our industry provided 33 percent of the electromechanical components. This means it provided a great training opportunity for engineering firms. It has also helped with the development of fuel elements for this plant. And it has enabled the CNEA to advance its training and acquire basic engineering technology through a technology transfer agreement signed with a Canadian atomic energy firm. This means that right now, Argentina can take on, using its own resources and with little outside assistance, the construction of power plants of the same type.

[Question] To what extent has the "brain drain," to use its everyday name, which has taken place over the past 10 years, affected the possibility of developing an independent technology?

[Answer] The brain drain does not affect the nuclear field. I would say that the great majority of [Argentine] personnel working in this field are in Argentina, and most of them are at the Commission. The rest are in businesses that will become more important as the nuclear plan progresses. And if at some given moment there was an exodus of highly skilled personnel from the Commission, now it can be said that they have all come back to the CNEA.

The Embalse Power Plant and the Brain Drain

[Question] In the eventuality of a nuclear holocaust, what would Argentina's role be?

[Answer] We would have to see where and how it happened, and its magnitude.

[Question] Everything suggests that Europe would be the "battlefield."

[Answer] If a nuclear war took place in the northern hemisphere, Argentina would be safe. The greatest concentration of radioactivity would be in the northern hemisphere, and air currents would carry radioactive material to the southern hemisphere, but it would not be... well, that is very hard to calculate. I have no idea of the magnitude. That is a very difficult question for me to answer because people might think I am saying that nothing would happen, but the consequences would depend on how many nuclear bombs were detonated. If they detonate a hundred... well, then the entire world would be contaminated. But if at most 20 were detonated, it would not be. The answer can't be made too specific because we would have to start from several hypotheses: which countries enter the war; how many projectiles they launch, and the power of each one. Because in the best outcome, it would end in a war in which only weapons were used, and not intercontinental missiles. If only tactical weapons were used, the effect on Argentina might be a slight increase in radioactive fallout. But if intercontinental missiles were used, obviously the impact on radioactive fallout would increase proportionally, and therefore, the number of cancers produced in the country would also increase in proportion. This means that the larger the quantity of bombs exploded, the larger the portion of the world that will be affected, and of course, the greater the effects caused by this radioactivity.

[Question] That isn't very encouraging.

[Answer] Of course it isn't. And that is precisely what maintains that delicate equilibrium which I mentioned earlier. The nations are aware of what might happen if there were a nuclear escalation. In the best case, the clash would not occur between the great powers. That would be even worse because the initial conflict would then spread to the entire world, as happened in the World Wars. And there might well be a considerable number of atom bombs in the world--in the eventuality that the development of nuclear weapons were not restricted--and that would have irreparable consequences.

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TECHNICAL DATA ON EMBALSE; PLANT'S IMPACT ON NUCLEAR PLAN

Embalse Development Background, Context

Buenos Aires ENERGEIA in Spanish No 35, May 83 pp 886-890

[Text] Latin American Nuclear Development

The heads of the 14 national nuclear organizations of Latin American met in Buenos Aires, convened by National Atomic Energy Commission Chairman VAdm (Ret.) Dr Carlos Castro Madero, to attend a conference on the region's nuclear development.

The high Latin American officials represent Bolivia, Brazil, Colombia, Costa Rica, Cuba, Chile, Ecuador, Guatemale, Mexico, Paraguay, Peru, the Dominican Republic, Uruguay, and Venezuela.

The conference was officially opened on Monday, 2 May, at 1200, at the central headquarters of the National Atomic Energy Commission. The ceremony was followed by a press conference during which the representatives of the news media were able to talk to the conference members.

On Tuesday, 3 May, the high Latin American officials attended the opening of the Embalse Nuclear Power Plant. Technical studies on research and production reactors, manufacturing and application of radioactive materials, prospecting, mining, and processing of uranium, and fuel element production were presented on the following day at the Ezeiza Atomic Center.

The conferees also visited the installations of the RA-3 nuclear reactor and the plants for the production of radio isotopes and intense radiation sources as well as the manufacture of fuel elements.

On Thursday, 5 May, they participated in a meeting with Argentine businessmen in the nuclear sector which had been organized by the Argentine Association of Nuclear Technology and on Friday, 6 May, they heard a dissertation by VAdm Castro Madero on the Argentine Nuclear Plan. On the following day, they visited the Atucha Nuclear Power Plant and the Bariloche Atomic Center.

Press Conference

The curiosity of foreign newsmen constantly revolves around Argentina's international position in nuclear matters, the possible direction of the country's nuclear efforts toward military goals, and the construction of the Gastre waste disposal facility.

The CNEA [National Atomic Energy Commission] chairman restated the already known Argentine position regarding the principalinternational legal instruments. He ruled out the possibility that the NPT might be signed, by virtue of its discriminatory character, and recalled that, on the occasion of the Geneva Conference it was impossible to arrive at any final document due to the stubbornness of the nuclear powers which refused to accept the violation of the treaty which they had incurred in failing to comply with the provisions of articles 4 and 6 of that treaty.

Concerning Tlatelolco, a treaty whose ratification is still pending, Castro Madero said that there is an effort underway to impose additional conditions on top of those that were required originally, dealing with possible nuclear explosions for peaceful purposes. Although right now there is no possibility of practical application along this development route, Argentina must not renounce it as a result of pressures of this type. If Argentina ratifies the Tlatelolco Treaty, the CNEA chairman concluded, it will do so with the requirements that were assigned earlier and it will not accept any new restrictive conditions.

Regarding the highly radioactive waste disposal facility, which foreign newsmen insisted on calling a "nuclear dump," being corrected on that score on various occasions by VAdm Castro Madero, the latter explained that the project's objective was the storage of the final products of the fuel cycle in a controlled and orderly fashion. He pointed out that, by tackling this point in a resolute fashion, Argentina actually moves ahead of its necessities during this stage of the cycle since the storage piles of the Atucha I and Embalse power plants will be saturated by the middle of the decade of the 1990's. The choice of an appropriate site--and this is how far we have gone here--was made on the basis of a detailed study of the granitic characteristics which guarantee stability for millions of years without any telluric movements and with perfect seal; at the same time, consideration was given to the resistance to high temperatures which radioactive materials will produce inside the disposal facility.

After repeating the previously-known position of the CNEA regarding the nuclear submarine, VAdm Castro Madero emphasized that the feasibility studies that were undertaken open up interesting prospects for the sale of intermediate-power reactors in countries in the area.

In response to the concern expressed by a newsman from Cordoba with regard to the impact which the operation of the power plant will have on the ecosystem, the CNEA chief recalled with particular emphasis that, above and beyond the sector's specific objectives, his agency always paid attention to considerations relating to the preservation of the environment. In the case of the water, which is returned to the river running along the power plant, Castro Madero said that the increase in the water temperature will not have any effect on the water, since there an 8-km drainage canal along which the water is cooled; at the moment of discharge on the surface of the river, there will only be a difference of 1°C between both temperatures.

Some representatives of the foreign media noted that the organized preachings and large-scale activities of antinuclear groups were not to be found in Argentina. Castro Madero attributed that to three causes: First of all, Argentine territory does not have major population concentrations, such as they can be found in Europe, which facilitates the location of nuclear installations sufficiently far from the big cities. Second, the population as a whole has great confidence in the nuclear power agency and in the competence with which the sector's undertakings are tackled. Finally, the CNEA chairman assured his listeners that the Argentine people views the achievements under the nuclear plan with great pride, fully aware of the rise in the technical and industrial level resulting from that.

In conclusion, and this could not be otherwise, VAdm Castro Madero was questioned regarding the possible diversion of sensitive materials for military purposes. In the official's judgment, the assumption as to an "Argentine bomb" would not imply any benefit for Argentina. This is so because it would produce a highly negative reaction in the countries throughout the region, triggering an arms race with negative effects on the economy of those countries, since this would take money away from development plans which would instead be channeled toward an activity which Castro Madero called "unproductive." This situation, he added would be harmful to the development of the nuclear plan such as it was conceived.

National Participation

As explained during the initial part of the inaugural ceremony by Capt Harry Leibovich, director of nuclear power plants, the construction of the nuclear power plant at Embalse represents a step forward in the development of Argentine nuclear industry and engineering. As in the case of Atucha I, the prior feasibility studies and the site selection were made in Argentina and the evaluation of offers submitted represented an effort which involved more than a hundred professors.

But the results constitute the most significant advance in the planning and construction of the power plant itself. In a typical nuclear power plant, investments are distributed in the following form: 8 percent for engineering, 15 percent for civil engineering construction work, and 17 percent for assembly, and 60 percent for electromechanical supplies.

At Atucha I, Argentina's first nuclear power plant, which began operating in 1974, there was practically no domestic participation in the engineering portion. But domestic interests represented 90 percent of the civil engineering work, 50 percent of the assembly work, and 13 percent of the electromechanical supplies.

At Embalse, a decade later, domestic participation accounted for 33 percent of the engineering work, 100 percent of the civil engineering construction work, 95 percent of the assembly work, and 33 percent of the electromechanical supplies.

The nuclear area accounted for a very significant part of the increases in engineering, assembly, and electromechanical supplies.

Among the two enterprises that made up the consortium which got the contract award for Embalse, AECL assumed responsibility for providing the nuclear system for steam generation at the power plant while Italimpianti took charge of the turbogroup and the other conventional equipment item.

The contract established a system aimed at promoting maximum participation of domestic industry and engineering in this undertaking.

In the nuclear area, detail engineering for civil engineering construction work was completely handled by an Argentine engerprise, as was the portion of the conventional sector. The basic engineering for a large part of the conventional mechanical systems, the electrical systems, and the radiological protection systems was also handled domestically.

The same happened with respect to detailed engineering work concerning electromechanical supplies for auxiliary systems in the nuclear area, ventilation, instruments, etc. Detailed engineering work for assembly was done domestically with the basic engineering knowhow supplied by AECL and Italimpianti.

Using the option provided for in the contract, the CNEA developed prototypes of instrument and control components and supported their local manufacture.

The following among the electromechanical components were made in the country: The turbine hall crane, the platform for the reactivity mechanisms, valves for pipes with a diameter of 2 m and the equipment intake lock which weighs 110 t and is 12 m long and 7.5 m in diameter. In the nuclear part we must also mention the moderator's heat exchangers.

An additional problem solved locally was the transportation--from Buenos Aires to Cordoba--of big components, such as the 240-t calender and the 304-t alternator stator which required the construction, among other elements, of a special 180-wheel truck and a modular overhead bridge.

Regarding electromechanical assembly, for which the CNEA and local enterprises handled 95 percent of the work, it is interesting to point out that the stiff qualification requirements for complying with the quality assurance standards must be added on top of the complexity of many systems and the huge dimension of certain components.

The project required the assembly of 30,000 m of pipes, 55,000 [m] of tubes, 82,000 [m] of power cables, 160,000 [m] of control cables, in the reactor and auxiliary services buildings, which, at peak times, required 1,000-1,200 persons to be working directly on the assembly of the nuclear area, with a total of as many as 3,900 persons on the job.

In particular it must be stressed that the special assemblies (fuel handling systems, reactivity mechanisms, process computer, instruments and control of nuclear island) were completely done by CNEA personnel which also participated with personnel of its own in the assembly of the fuel channels, in cooperation with AECL personnel.

A final comment on the civil engineering phase will give the reader an idea of the project's dimensions and the country's participation. As we said earlier, the civil engineering work was done 100 percent with local help. It required 700,000 m^3 of earth movement, 80,000 of concrete, and 9,000 t of structural steel. A sliding steel framework, which grows to a height of 42 m, was used for the concrete work on the reactor building whose wall is 1,100 cm thick.

Supplies and Self-Sufficiency

The Embalse nuclear power plant is supplied with natural uranium as fuel. The selection of the latter, in contrast to enriched uranium, which is preferred by other countries, is due to the fact that its manufacture is much more accessible for an intermediate developing country, such as Argentina. Argentina has reasonably secure reserves of uranium which are sufficient to supply the needs of the ten power plants, such as Embalse, for their entire useful life although its uranium-bearing potential is much greater.

The annual consumption at Embalse with a load factor of 85 percent is on the order of 95 t of uranium. The fuel is made up of clusters of hermetically sealed pipes within which the uranium is contained in the form of pellets. The power plant's core consists of 4,560 of these cluster or fuel elements, each one of which contains 19 kg of uranium, approximately.

Because of Canada's policy requirements, Argentina was unable to acquire the technology for making these fuel elements; this is why the CNEA found itself obligated to do its own development work.

The fuel element manufacturing line of the Embalse type was installed at the Ezeiza Nuclear Fuel Element Plant; it began to operate in 1983, producing successive series of elements earmarked for the improvement of the product and it reached normal production at that time which is 5,000 fuel elements per year.

For contract guarantee reasons, the reactor at Embalse began to operate with fuel elements of Canadian origin and, because of the daily exchange of those elements, replacement with those of domestic origin must be progressive. At the same time, keeping in mind the fact that the development of fuel elements was accomplished independently, it is necessary to introduce domestically produced elements according to a pre-established irradiation and verification plan.

The development program covered a series of complicated stages in the laboratory and the pilot plant. Except in the manufacture of dioxide pellets, on which we already had broad experience domestically, it was necessary for the remainder of the process to start only with available public information on design, processes, and production equipment.

This made it necessary to design and build highly sophisticated equipment domestically, equipment which it was impossible to obtain on the market otherwise. That job was done by the CNEA, together with INVAP S.E. [Applied Research Institute, Government Company], which together handled the engineering for most of these items, as well as the follow-up work in terms of construction, arming, and start-up.

The result of all of this development is multiple one; the utilization of domestic uranium makes it possible to replace 1,250,000 t of petroleum (or 1,900,000 t of coal); the domestic production of fuel signifies an additional foreign exchange saving of $6 million per year and the patents for the equipment developed and the manufacturing knowhow remain available.

The adoption of the natural uranium line necessitates the use of heavy water which is needed not only as a fuel element coolant but also as a moderator.

In the moderator medium, the velocity of the vast neutrons, with little probability of producing new fissions, is reduced, so that they then become thermal neutrons, capable of splitting new fissile nuclei of uranium, thus achieving self-sustained fission.

To meet the needs of the program of the nuclear power plants in medium-range terms, a Swiss firm is setting up an industrial heavy-water plant with a design capacity of 250 t/yr at Arroyito, Province of Neuquen. In this way, Argentina moves even closer to being independent of foreign sources in connection with the accomplishment of the nuclear plan which was approved by Decree No 302/79.

Castro Madero Stresses Continuity

Buenos Aires ENERGEIA in Spanish No 35, May 83 pp 892-94

[Speech by VAdm Castro Madero]

[Text] The facility we open today marks a new step on the road which Argentina embarked upon more than 30 years ago in an effort to gain mastery of nuclear technology for exclusive application to national development, to the improvement of health and the wellbeing of all of the Republic's inhabitants. It has also been the constant objective of this effort at the proper time to use its benefits also in support of greater colloboration and integration with the Latin American countries.

The simple outside appearance of this power plant on the inside shelters a complex technology which tested and strengthened the nation's technical-industrial capacity.

This facility constitutes further testimony of what can be achieved when, in pursuit of a policy, factors of continuity and coherence are combined within a strict ethical framework.

This continuity and coherence, which are preserved throughout the history of the National Atomic Energy Commission, in spite of the political vicissitudes which the country had gone through, made it possible to support, for the power plants, the selection of the natural-uranium and heavy-water based reactor line which enables the country to achieve the greatest possible autonomy in the nuclear field so as to permit the local development of the entire fuel cycle.

This new achievement is the result of the responsibility of many of those who designed it, of those who decided on its construction, of those who supported its execution, and of all those who helped overcome the difficult problems both in the technical and economic-financial fields and in the field of international politics.

The transcendency of this event here today is reflected by the presence of the President of the nation to whom, in the name of all of the personnel of the National Atomic Energy Commission, I once again express our appreciation for his determined support, a feeling extended to his predecessors in this high office.

I also want to express appreciation for the presence of the governor of Cordoba, the representatives of the commanders-in-chief of the ministers, secretaries of state, and judicial, military, federal, provincial, and municipal authorities and officials of the various subdivisions of the national and provincial government who have gathered here to evidence the support of the national government and the province of Cordoba for the activities being carried out by the National Atomic Energy Commission.

The presence at this ceremony of church, political, educational, scientific, technological, and cultural personalities, whom I thank most profoundly, is something which we here interpret as an expression of agreement in supporting a national program.

The idea of building this nuclear power plant was conceived by the EPEC (Provincial Electric Energy Enterprise) which actively collaborated with the CNEA in the feasibility study and later on in the project's subsequent phases.

Following the so-called competitive bidding phase and the analysis of the proposals, the project was awarded to the consortium made up of the Atomic Energy of Canada Limited and Italimpianti enterprises, with the former taking care of the nuclear sector and the latter handling the rest of the installation, including the turbogroup. The contract took effect in April of 1974.

The fruitful cooperation of the CNEA with these enterprises, both of which are government outfits, made it possible to achieve more than 50 percent national participation in the entire project.

The high degree of development of natural-uranium and heavy-water reactor technology in Canada is in keeping with a self-sufficiency objective similar to the one which the Argentine Nuclear Plan pursues and that was the objective that counted heavily in the selection of the nuclear sector supplier.

The AECL enterprise was the one which, after working out the design of this reactor, was capable of coming up with a combined effort with Canadian engineering, supply, and electric power generating enterprises which, under its direction, produced the technological reality today represented by the CANDU reactor that earned Canada undoubted benefits.

Canadian Mining Minister Judith Erola, to whom I very particularly want to express my appreciation for having come to Argentina to share this event with us, undoubtedly must feel satisfaction over seeing--at the other end of the American continent--a technological development from her country which is the fruit of perserverance and which was achieved in an autonomous fashion.

This facility constitutes an excellent base for the further in-depth development of our relationships in the nuclear field. In this sense, mutual understanding regarding respective positions in safeguard matters will be fundamental. Through the Italimpianti enterprise, Italy here once again proved its historical and world-renowned capacity in handling huge and complex engineering projects. The power plant's conventional sector, which was its responsibility, reveals a high degree of technology value which Argentina's industry managed to assimilate and which, in various ways, can be reflected in future projects.

As a response of Argentina's technical capacity in meeting the requirements of this facility, it must be emphasized that domestic participation in the engineering area was 35 percent, in civil construction engineering it was 95 percent, and in assembly work it was 90 percent. Under this last-mentioned heading, the power plant offered an opportunity for domestic enterprises, grouped in consortiums, to acquire knowledge and experience in handling the assembly of the nuclear and conventional sectors. This is today a very important basis for the future development of the nuclear plan and it is a very valuable item when it comes to offering services abroad.

It is important to point out that, in order to make maximum use of the investment represented by this power plant, CNEA took over the role of main subcontractor for construction work in the nuclear area, a situation which is undoubtedly not typical when it comes to carrying out this type of contract worldwide. This helped strengthen the participation of local service enterprises, it gave us a headstart in training manpower, and we were also able to speed up the pace of construction and to get a greater yield out of the available resources and funds.

With the same purpose in mind, the CNEA took over the task of assembling the nuclear reactor's critical systems, such as the calender, the fuel channels, the reactivity mechanisms, and the fuel transfer system.

The construction of this power plant also gave the CNEA an opportunity to gather new and valuable experience in the administration of a highly complex project; it furthermore made it possible to acquire basic engineering capacity through a technology transfer agreement signed with AECL, simultaneously with the specific contract for this project.

As a result of the experience acquired and the license provided for in that agreement, Argentina today is in an immeasurably better condition when it comes to tackling the future construction of this type of power plant with its own means.

As proof of the capacity attained by the nation's industry we must stress the fact that it provided 33 percent of the electromechanical supplies in which connection it had to meet the very demanding quality levels that make it possible to guarantee a high degree of reliability in the power plant's operation.

Achieving the highest quality levels required by nuclear operations in Argentina is one of the most important facts in Argentina's industrial and technological development.

Because of the change in export policy adopted by the nuclear technology supplier countries following the signature of the construction contract for this power plant, the CNEA found itself forced to step up national integration regarding the fuel element; this required the development of highly sophisticated processes and the design of machinery with a complex technology. On this last topic, INVAP S.E. once again demonstrated its importance as one of the executive arms of the Argentine Nuclear Plan.

The success of this effort is clearly pointed up by the fact that we today have a domestic production line in the nuclear fuel factory at the Ezeiza Atomic Center which will take care of the future supply of the fuel for this nuclear power plant.

This electric power plant will add 600 MTU net to the national interconnected grid and will raise the electric share in the total installed power in the country to 10 percent.

It is a fact that this power plant is being started up at moments when, due to the current economic situation, there is a temporary surplus in the electric power generating part; but we do not doubt that the electric power demand will again grow soon and that this will call for the availability of energy through new power plants, including the nuclear power plants, which will guarantee a high degree of power generating reliability for the full employment of the country's industrial infrastructure and for its growth.

Having said all this, I feel that I should single out the magnificent job done here and to congratulate all personnel of the various domestic and foreign enterprises which made this reality, which we see before us today, possible.

The names of the vast majority of those men and women who made every effort to bring this project to fruition will remain unknown but that will be compensated for by the intimate recognition of those who are closest to them.

To all foreign engineers, technicians, and workers who for several years with their Argentine counterparts shared in working out the solution to problems, the correction of mistakes, and the resolution of difficulties inherent in undertakings of this magnitude, I want to express our appreciation along with the wish that, upon returning to their homelands, they may take with them happy memories of Argentina and its people.

To the personnel of the CNEA I want to say that their work, their effort, are a credit to this institution and earned them the sustained support and respect of the entire country.

I am aware that the results attained were possible only thanks to the kind of dedication that was above and beyond the obligations of family life and well-deserved moments of rest.

In this expression of appreciation I include the thanks which we owe to the city authorities, to the personnel of the schools and the police, to the merchants and professional men, and, in general, to all people living in the area around here whose support is in vivid contrast to the negative attitude that one can observe in areas close to nuclear installations in other countries. This support to a great extent is the reflection of the maturity of a population who does not ignore the responsibility displayed in tackling the construction of nuclear power plants in Argentina.

As in the case of Atucha 1, the surrounding area is integrated into the life of the power plant; we hope that this new installation will become an element of pride for the people here and a center of attraction for the settlement of Argentine professionals and technicians.

To the communities in the area and to all Argentines I want to say that the concern with preserving and improving the quality of life of each inhabitant permanently orients our technological development effort, carried out as it is in strict compliance with the standards and criteria of radiological protection and nuclear safety. In this sense, and as we have done in the case of the various agencies and specialists concerned with the ecological aspects, we shall continue to pursue our policy of communication with all sectors of Argentine society that are desirous of perfecting the knowledge they have regarding the possible effects deriving from the operation of nuclear installations and their possible repercussions.

I also consider it indispensable to repeat here, before the distinguished authorities of the atomic energy agencies of our sister countries, who honor us with their presence here today, our will to transfer--on balanced foundations--our scientific, technological, and industrial advances in order to contribute to the progress of nuclear activities in the region, all of this within our independent and open policy which respects the rights and sovereignty of all states.

Most Excellent Mr President: The synchronization with the grid on 25 April marked the end of a fundamental phase in this project which served in practice to prove the technical correctness of this power plant design and the broad possibilities of national participation which it offers. We trust that it will be confirmed by the as yet pending task of starting operations which, thanks to the budget support we received, will make it possible to launch commercial operations during the second half of this year.

Through this undertaking, Argentina has firmed up its position in the nuclear electric power field, it has strengthened its confidence in its own resources in order to tackle new undertakings and it has boosted its policy of promoting an independent nuclear program exclusively dedicated to peaceful purposes.

It will stand as a very important experience in the broadening of national participation and in acquiring new national capacities. The current availability of human resources has placed us on the level of definitely mature countries both in terms of utilizing the advances of knowledge and in terms of promoting them.

This maturity is a good foundation for a greater scientific-technological approach to the leading countries in the nuclear field.

In this sense, I reiteratedmy confidence in the fact that Argentina's position in the matter of safeguards, by virtue of its strength, reasonableness, and openness, will finally be understood and that this understanding will be expressed in the restoration of equitable relationships with governments that pursue restricted policies which we consider discriminatory.

Just as the Argentina of today feels that the nuclear plan serves the highest national interest, so there is no doubt in my mind that the people of Argentina of tomorrow will find confirmation of our expectations through the formidable impact which undertakings, such as this one, will produce in terms of national industry and engineering quality levels, increasing our ability in dynamically keeping up with a process of technological innovations destined to improve the quality of life of our population, our technological development, and Argentina's relative position in the world.

I trust that the operation of this nuclear power plant will help speed up an economic revival which, together with national unity, with cohesion indispensable in tackling problems commonly shared by all Argentines, will contribute to the endless task of building--with God's protection--our united, stable, and permanently progressing country which we all want.

Nuclear Plan's Future Outlined

Buenos Aires ENERGEI A in Spanish No 35, May 83 pp 895-896

[Article by Martin F. Yriart: "The Nuclear Plan After Embalse"]

[Text] Looking at it in retrospect, the period of 1976-1983, in the context of Argentina's nuclear development, represents one of the most decisive and at the same time most difficult transition phases. In a country where one installation is finished for every 33 cornerstones laid and where each new administration tries to wipe out with a single stroke of the pen what the preceding administration did or wanted to do, the nuclear sector is an exception also in this sense.

If there was one project that dominated the panorama during those 7 years, it was the Embalse project. Launched in 1971, it is one of several that was inherited by VAdm Castro Madero when he took over as chairman of the CNEA in 1976. At that time, the Embalse project seemed doomed, just like many other nuclear power plant projects throughout the world, plagued by technical and financial difficulties. At that time there was no dearth of prophetic voices at home and abroad, with axes to grind, that predicted the interruption of this undertaking, the cancellation of the contract or the alternative, for Argentina, to renegotiate under conditions ruinous for its interests both in economic and political terms.

None of that happened. The decision to finish the job was carried forward tenaciously. It would have been easier to leave it by the wayside and put the

blame on those who made the initial decisions. It would have been possible to push other projects whose merit would be exclusively that of Castro Madero and his closest collaborators. It would have been possible to simplify the internal management problems of the CNEA. Perhaps some failures and setbacks and minor troubles could have been avoided in this fashion.

But, as in any enterprise that experiences difficulties threatening its survival, the important issue here was to save the assets and particularly the profitability centers. The start-up of the Embalse plant means a powerful impetus for the nuclear plan in many ways but especially in two ways.

It saved the credibility of the CNEA and the nuclear plan which would have suffered very severely--and perhaps in an irreparable manner--from the failure of this project.

It made it possible to incorporate a new source of earnings for the plan, in turn containing the growing financial cost deriving from an undertaking of this magnitude, as the project fell further and further behind schedule.

There are those who maintain that the opportunities in favor of Argentina in the matter of technical transfer and national participation were not fully utilized because of the way in which contract relations were handled. The main objective however, was attained. The power plant's cost--$1,300 million, as announced by Castro Madero at the plant's opening--is 100 million less than was estimated a few months earlier.

Among the inheritance received in 1976, another two major projects were completed during the 7-year term: the nuclear fuel element factory and the special alloy plant. And the commitment to complete and start these two key plants in the fuel cycle--which was of foreign origin--has been no less.

Thanks to that, Argentina today is self-sufficient in the matter of nuclear fuels and not only has the material and human resources for pushing their production but also has a mastery of the technology involved and the basic scientific backup capability to continue to develop in this sector and to participate on the world market on a footing of equality with the other industrialized countries. It was not without surprise that we learned recently that Canada, the world leader in natural uranium reactors, does not have the technology for making zircalloy (nor, in this particular case, does it have the knowhow of fuel reprocessing which is necessary for the recovery of the plutonium that can be re-used in the CANDU reactors).

These and other undertakings of lesser dimensions--although that does not make them any less important--which were launched or planned in 1976, could be completed in spite of the adverse conditions experienced by the national economy, thanks to the fact that the country's real objectives in nuclear matters were placed above any personal egotism or vanity.

The new projects under the nuclear plan, on the other hand, were bound to suffer repeated postponements and it is obvious right now that their completion

will be the responsibility of a new administration. As of today, now that the nuclear sector is up-to-date with the projects begun before 1976, we must ask ourselves what state the plan is in and what future awaits it.

Nuclear Power Plants

In its original estimates, the plan called for the construction of four nuclear power plants of 600 Mw which were scheduled to go into operation in 1987, 1991, 1994 or 1995, and 1997. The first of these, Atucha 2, was begun 2 years ago and is 18 months behind schedule. The second one, with an as yet undetermined location, was to have been approved in 1983 although that decision was postponsed by one year. The next administration (assuming that a constitutional term of 6 years will be completed) will have the responsibility of finishing Atucha 2, possibly trying to catch up, and starting the work on two new power plants. But in addition it will be necessary to decide whether we are to go ahead with the contracting method established with the creation of ENACE [Argentine Nuclear Enterprise for Electrical Power Plants] and above all what reactor technology will have to be adopted for the remaining three power plants.

Uranium Production

Although the country has certified reserves sufficient for ten reactors, for 30 years of operation, the effort to get the Sierra Pintada deposit working at full speed, by shifting it to the private sector, did not meet with success. The country's political stability and institutional normalization can play a favorable role in this sense but the major effort will inevitably have to be made by the new authorities who will have to face a specific increased demand produced by Atucha 2 for at least a couple of years before it is started up and they will also have to make sure that the second and third power plants under the plan will have an assured supply.

Fuel Production

In the light of what we said before, it will also be their responsibility to apply the uranium dioxide production capacity, realizing that, for the rest of the current year, the national technology line at the Cordoba plant will be started up at the regular rate. The start of production, on an industrial scale, at the zircalloy pipe plant is another event scheduled for 1984 and, in the FECN [Nuclear Fuel Elements Enterprise] we still have pending the start-up of the CANDU-type fuel production line on an industrial scale and the final test of the design and completion of the fuel manufacturing process of the Atucha 2 type, including the necessary additional equipment. Another pending problem involves the manufacture of zirconium sponge.

Heavy Water

A key responsibility that will be passed on to future authorities involves the completion and start-up of the industrial-scale heavy-water plant at Arroyito which is to supply the initial charge for Atucha 2. If that project is not completed in time, Argentina will have to purchase or rent a part or all of

that charge abroad; this, in turn, raises the question of who the supplier is going to be. The possible recourse to the USSR will not fail to trigger disagreement. Concerning the development of its manufacturing technology, we then face the need for completing the experimental plant at Ezeiza and Module 80.

Reprocessing and Final Products

The radiochemical process laboratory--better known as "reprocessing pilot plant"--can be completed at the current rate next year, being checked out "cold" in 1985 and running on irradiated fuel in 1986. But for that it is necessary simultaneously to build a treatment plant for the final products of the cycle, including its various forms of final packaging (in glass, concrete, etc.)--a project which calls for prompt execution if we do not want to postpone the utilization of the LPR. Other satellite projects here include the laboratories or pilot plants for the conversion of plutonile nitrate [as published] into plutonium dioxide and the production of mixed-oxide pellets. Finally, it remains for us to finish the studies for the disposal facility begun in Gastre and the final decision as to its construction; all of this must be spelled out and firmed up before the end of the current decade.

Basic Research

The TANDAR electrostatic heavy-ion accelerator is virtually finished but there has been a postponement in the work on the laboratories that will supplement it to form the national research center planned at the Constituyentes Atomic Center.

The installations and projects mentioned above by far do not complete the entire panorama which the new administration will find in the nuclear sector. Although it is impossible today to have any reliable statistics, it is clear that the investment commitments to be adopted in order to push all of these undertakings will represent a sum on the order of $5-10 billion. With few exceptions, this involves productive investments, intended to meet the energy demand, to replace fossil fuels, and to expand the industrial capacity of the nuclear sector.

Although they were for the most part drafted as projects starting in 1976, they do spring from the impetus imparted to Argentina's nuclear development from the middle of the decade of the 1960's onward. They were planned well into the start of the following decade. If this is a sector of national life in which continuity predominated, then nobody can today close his eyes to the reality of the changes that appear to approach us with ever greater speed. As the pre-election period comes closer, we have recently noted a statement from the political sectors on this fact and on what should be done in nuclear matters. This is a statement which, in this and in other fundamental aspects of national reality enables the country to choose policies rather than politicians.

Embalse Thermomechanical Installations

Buenos Aires ENERGEIA in Spanish No 35, May 83 p 903

[Text] For reasons of safety which must prevail in nuclear power plants, that are increasingly subjected to public criticsm, any element in those plants must be reliable and must be subjected to strict controls.

The air conditioning and, in general, the thermomechanical installations, perform an important function in maintaining temperature and humidity conditions within limits that guarantee the correct operation of the equipment and installed machinery.

In particular we must single out here the cooling of the sector taken up by the reactor since this is one of the places where heat dissipation cannot exceed certain limits in any case.

Another important facility is the control room where highly sensitive electronic equipment cannot be exposed to temperature rises without entailing serious risks in terms of proper operation. Hence the need for using reliable and highly tested equipment for cooling purposes which will guarantee the safety of personnel and equipment installed in these facilities.

The Carrier cooling machines were installed in many nuclear power plants in the United States and other countries throughout the world; they are permanently needed for new power plants on the drawing boards and under construction. In some cases, instead of using cooled-water-producing machines, we directly use a natural flow of cold water but those possibilities keep shrinking more and more because of the difficulties in obtaining them and also because of the possibility of producing changes in the ecology of the rivers.

For the Embalse Rio III nuclear power plant, Lix Klett S.A.I.C. supplied the complete refrigeration plant, made up of four Carrier centrifugal compressors of 310 tr, each, using two of these machines as reserve for the plant.

This refrigeration plant supplies the cooled water intended for the reactor sector and the air conditioning equipment intended for the control room of the auxiliary wing, thus making it possible to maintain controlled summertime temperatures not exceed 28°C.

A temperature not exceeding 40°C is also being maintained in the turbine building and the auxiliary vessel building from levels of 97.35 up to 118.55 by means of 42 air conditioning units for which water coming from the lake is circulated and then recirculated back into the lake.

During the winter, a temperature 18°C is maintained by means of 16 heat blowers.

These systems are supplemented by means of mechanical ventilation consisting of ten centrifugal exhaust fans of 60,000 m^3/hr, each.

In the diesel electric power generating group building, we maintain a temperature of 18°C throughout the winter by means of heat blowers and mechanical ventilation with four axial exhaust fans of 40,000 m^3/hr, each.

Through a system of automatic controls we control the opening and start-up of the exhaust systems, permitting adequate ventilation in the various rooms.

By way of data illustrating the importance of the thermomechanical installations in this nuclear power plant, we must emphasize that, to operate the thermomechanical installations, we require 2,380 hp; the heat exchangers have a total capacity of 4,650,000 kcal/hr and the centrifugal compressors have a total capacity of 1,240 tr.

Except for the centrifugal compressors and the automatic controls, the rest of the equipment is produced in Argentina and the engineers, technicians, and workers employed in their assembly are also Argentine.

5058
CSO: 5100/2072

AEC HEAD HOLDS PRESS CONFERENCE ON TARAPUR

Bombay THE TIMES OF INDIA in English 12 May 83 pp 1, 9

[Text] May 11.

Mr. H. N. Sethna, chairman of the atomic energy commission, today admitted that "in a small percentage of cases" workers at the Tarapur Atomic Power Station (TAPS) had been exposed to radiation in excess of the annual dose limits set by the International Commission on Radiological Protection (ICRP).

Under insistence from reporters, he, however, provided statistics that showed that 329 persons had received radiation in excess of the standards set since October 1969 when the plant was commissioned. Of these, 200 were exposed in 1975 when there were two refuellings because of the demand for power that year.

There was no exposure the first three years because the reactor was not opened for refuelling as there was no need to do so, he said. But the figures from 1972 to 1982 were 31, 7, 38, 200, 28, 17, 4, 1, 1, 0 and 2. The extent to which these persons were exposed was not disclosed at the press conference.

No Hazard

Mr. Sethna said that the figures read out by this correspondent of the average exposure at TAPs between 1972 and 1982 were correct. In all these years the average dose was well over four times higher than the norm of 500 millirems. The figures in millirems are: 1972--2,950, 1973--2,520, 1974,--2,990, 1975--3,485, 1976--3,311, 1977--2,947, 1978--2,867, 1979--2,510, 1980--2,236, 1981--2,233, 1982--2,222.

However, he argued, there was no health hazard because the prescribed limits were not to be construed as "absolute" even according to the ICRP. If in any year, the dose exceeded the guideline limit, the dose in subsequent periods could be minimised and the average could be held down to the prescribed value. This was the normal practice for work in radiation areas, he and other officials argued.

When it was pointed out that an official DAE report had recommended in the case of an employee who had received 18,240 millirems in 1976 that "his

future exposure should not exceed 5,000 millirems a year." Dr. S. D. Soman, head, health physics division, said that was a mistaken formulation "because of the English used."

Exposure Limit

When correspondents at the press conference, called by Mr. Sethna in connection with a report in this paper on Monday, argued that what mattered was the exposure the worker received and not the dosage over a period, that the standards set were a matter of controversy because it was a question of who set them, and that the effects of a low dose of radiation over a long period of time had not been adequately studied, the officials contended that the limits set were an "acceptable risk".

While the permissible radiation exposure was 5,000 millirems per year, they quoted from an ICRP publication (number 26) which said that an individual could be exposed to radiation of up to 10,000 millirems at any single exposure and up to 25,000 millirems in his lifetime.

When reporters insisted that they be allowed to look at the records, Mr. Sethna ultimately agreed to permit them only to "see" them, provided they were not taken out.

Mr. V. N. Meckoni, director of the nuclear safety group and chairman of the safety review committee, intervened here to say that the limits of 5,000 millirems per year for an individual were set low to have a high factor of safety.

He contended that even a dose of 15,000 millirems was "quite safe from the health point of view". But anyone who received this dose would not be allowed to work in a radiation area, so that the total exposure received by him in three years did not exceed 15,000 millirems.

The DAE officials had no comment to make on a statement by Dr. Karl Morgan of the ICRP that "for man, there is never a complete repair of radiation damage."

Later, asked how, in the face of growing evidence to the contrary, an absolutely categorical affirmation could be made that a dose exceeding 5,000 millirems is "not unsafe", the DAE officials said that it was a matter of "opinion" and "scientific controversy". They also conceded that more and continuing research is needed to arrive at safe limits but held that the ICRP norms were adequate and form the basis for the DAE's standards.

Mr. Sethna also said that he was in favour of setting up of an atomic energy regulatory body to make recommendations on matters of safety, which will be binding upon the DAE. He said, however, that the body will consist only of "experts" and will not include any representatives of employees or the public.

Mr. Sethna said at the outset that the government was fully seized of its responsibility towards the health and safety of the population at large and

of the environment and would do its utmost to discharge its responsibility as laid down under the Atomic Energy Act.

He said it was "totally incorrect" to say that the permitted lifetime dose for an individual was 50,000 millirems. The correct figure was 100,000 millirems, though at 50,000 millirems there was a medical review. Later it was elaborated that chromosome tests were done at this stage.

A press note issued at the news conference said that the power output of TAPS was not being restricted to prevent the emission of radiocative matter into the atmosphere beyond permissible limits. "Such emissions are at very low levels and well within the permissible values," it was stated.

When asked to specifically comment on this, Mr. Sethna said that even when a unit was operating at 210 MW, the gaseous emission was never more than 14 per cent of the permissible limit.

TAPS, however, had a reactor of an "early design" and, therefore, had "certain inherent limitations due to the designs then adopted".

Because of this, "comprehensive methods of protecting both the plant personnel and the environment" were absent from this plant. "Backfitting" to incorporate the improved thinking, consistent with plant limitations, had therefore been done.

The statement said that it was a "fact" that the non-availability of spares was "a matter of concern". But the safe operation of the plant or the health and safety of the personnel had not been allowed to be endangered, it was contended.

As for using outside personnel for maintenance and refuelling, the statement said this was a common practice with nuclear power stations in other parts of the world also.

Medical chek-ups

Asked if illiterate villagers were used to do the high risk maintenance jobs, Dr. K. P. Rao, chief superintendent of TAPS, admitted that this was so. He was, however, cut short by Mr. Sethna who said that villagers were given unskilled jobs after using audio-visuals explaining the task to them. Earlier, he said that they were given these jobs after being given mock-up training "under inactive conditions."

Mr. Sethna and other officials also insisted that all workers in radiation areas were being constantly monitored and given a yearly check-up. These check-ups had not shown any ill-effects, so far. Radiation control measures at the plant were supervised by the health physics unit which worked independently of the plant management, but under the DAE.

Commenting on a statement by Dr. R. Ramanna on the need for lowering the DAE's standards of safety, quoted by a correspondent, Mr. Sethna said he

was not aware of the statement but that it does not reflect the policy orientation of the Atomic Energy Commission.

Dr. Ramanna had said: "I would like to ask, Are we not spending too much money on health and safety? Should we not have a look and find out whether the international standards of safety (in nuclear programmes) are indeed that necessary?...should we follow the international standards blindly? I think we should have courage to look at these standards especially where they are leading to runaway costs."

CSO: 5100/7109

SOVIET PLANE UNLOADING URANIUM IN DELHI DESCRIBED

Lahore JANG in Urdu 30 May 83 pp 1, 8

["Special" report]

[Text] New Delhi — The Soviet Union has started supplyin_ uranium to India while the West Germany and especially the United States are contemplating imposing conditions on such supplies to India.

According to the report received, a mysterious plane landed in Delhi on a very secret mission. The Russian Aeroflot plane landed while guerrilla troops were guarding the airport. The uranium was later loaded on special vehicles. The trucks carrying the uranium processed for use in weaponry were escorted under strict guard armed with the latest weapons. The convoy was led by a special security jeep with special forces personnel riding in it. The jeep was named "Follow Me."

Before being loaded into trucks, the boxes carrying uranium were carefully checked by the secret police. The convoy was guarded by both Soviet and Indian security men. All the boxes were delivered to the Rajasthan atomic energy plant via Hariana. The operation was carried out with so much care that it looked very smooth and orderly. The plane bringing the boxes was parked near the glass walled visitors gallery. After the boxes were unloaded, the plane was parked in the green field area of the airport. The landing was strictly secret and even the control tower was not given prior notice of the landing. Security was so strict that the radar operators were informed only a few minutes before the actual landing time.

We might as well inform our readers that no plane is allowed to land without the knowledge of the radar operators and the control tower personnel. The whole carefully planned secret operation appeared normal in only one way — a Soviet diplomatic couple speaking Russian-accented English was present in the visitors gallery and was watching the operation. A Soviet security official in a Jeep drove to the cargo plane bringing the boxes and as soon as the arrival of the special plane was announced.

CSO: 5100/4715

EXISTENCE OF LARGE URANIUM DEPOSITS CONFIRMED

Karachi DAWN in English 30 May 83 p 4

[Text]

FAISALABAD, May 29: After a series of laboratory tests since the discovery of large deposits of uranium in different parts of Pakistan, it has now been established that the newly discovered rocks have high percentage of uranium contents.

This was revealed to "Dawn" by a source close to the Pakistan Atomic Energy Commission here on Friday.

According to the source, the Tharparkar desert in Sind province was considered favourable for uranium deposits in concrete types of rocks.

The source further stated that a close survey was also made of the entire desert area of Pakistan including Cholistan, Thal Dasht and Mekran, covering over 60,000 square kilometres during the current year, with positive results.

With this discovery, the source added, another uranium bearing geological formation has been identified which extends to over vast areas in the country.

Furthermore another vast tract of land, between Mansehra and Thakot, has been earmarked as a potential pocket of uranium after chemical analysis. A large number of samples drawn from these places have shown uranium content of 0.2 per cent. The source added that in the coastal areas of Karachi a number of promising spots have been explored at Pasni, Gwadur, Ormara and other places.

Exploration work in Sonmiani has indicated presence of about 4 million tons of heavy minerals, including uranium.

Likewise, a number of uranium bearing spots have been located in the eastern Potwar on both sides of River Indus. The most important among these are Isa Khel, Mir Ali Thal, Khisor Ranges, Shanwah, Karak, Taman, Mindi Shariqi, Kakhad, Larimar, Pir Fatehal, Tabiser, Massan and Soan river area beside the district of Hazara and Rajanpur.

The areas of Bhimber, Bannu, Thakot and Kaghan valley are also being mapped and explored, the source concluded.

CSO: 5100/4716

BRIEFS

REPORT ON A-BOMBS FOR LIBYA REFUTED--An official spokesman in Islamabad refuted a report broadcast by Israel radio, alleging that Libya has received five atom bombs from Pakistan. The spokesman said the report is part of a campaign of provocative propaganda against Pakistan and is totally baseless. The spokesman reiterated that Pakistan's nuclear policy is for peaceful purposes and Pakistan has no intention whatsoever of making an atom bomb. The spokesman said the Israeli radio report was a fabrication and was absolutely unfounded. [Text] [KB071531 Karachi Domestic Service in Urdu 1500 GMT 7 Jun 83]

NUCLEAR MEDICINE IN COLLEGE--Lahore, 2 Jun--A new subject of Nuclear Medicine will be included in the curricula of the medical colleges in the country for which Pakistan Atomic Energy Commission (PAEC) and the Pakistan Medical Research Council (PMRC) are working jointly. This was stated by Mr. Munir Ahmad Khan, Chairman of the PAEC here on Wednesday. He was giving away certificates to the successful participants of a two-month course on "Application of Nuclear Medicines and Radiotherapy." The course was organised in the Atomic Energy Mineral centres and was conducted by the Nuclear Medicine Institute, Lahore, in the Mayo Hospital. About 13 young doctors from all parts of the country were awarded certificates. Mr. Munir Ahmad Khan suggested that there should be more medical institutes in the country as at present over 800,000 patients were being given treatment in only six centres in the country. [Text] [Karachi DAWN in English 3 Jun 83 p 11]

CSO: 5100/4716

PAPER SAYS NO NUCLEAR ARMS FOR AFRICA

EA121946 Nairobi SUNDAY NATION in English 12 Jun 83 p 6

[Text] The outgoing secretary general for the Organization of African Unity (OAU), Mr Edem Kodjo, last week made one of the most useless proposals during his 6-year tenure as chief executive of the African body.

According to Mr Kodjo, African nations should develop nuclear weapons to confront South Africa's white minority regime which is oppressing an African, Asian and colored majority.

Let us not be fooled, he intoned in perfect French, about denuclearizing Africa when South Africa has a nuclear arsenal. Against whom is it manufacturing its atomic bombs? Against us, of course, and the duty of the African states that can is to resolutely embark on the nuclear path...[ellipses as received]

We do not intend to argue against Mr Kodjo's assertion that South Africa poses a threat to African states. Indeed, the racist regime in Pretoria is a danger to nations bordering it, which have only conventional weapons.

It has been argued, and we cannot dispute the argument, that pressed against the wall by nationalist forces, it is conceivable that the Pretoria regime might use nuclear weapons as the last act of defiance. Crazy things are possible in the world, including Pretoria.

At the same time, we believe it is the duty of all African nations to protect the African peoples, including those still held in bondage by the Pretoria regime. That Kodjo should emphasize this is commendable, although this has become routine.

It is apparently in an effort to avoid repeating what has been said in the past in regard to the policies pursued by the Pretoria regime that Mr Kodjo thought it wiser--maybe progressive--to call on African nations that can to develop nuclear weapons. He thereby erred.

We do not believe that at the moment there is any nation in Africa capable of embarking on the nuclear path. The brains are certainly there, and a number of African states, mainly Arab, operate nuclear reactors.

But it is doubtful they have paid for them fully and even more doubtful they have the funds to buy the equipment needed to develop nuclear weapons. This they must do because none of the nuclear nations in the world today will sell the weapons.

It is, in our view, very poor wisdom for any nation in Africa to spend its scarce resources to acquire nuclear weapons.

African nations are plagued by problems arising out of shortage of funds for sure, but a substantial number of them out of sheer incompetence. There is certainly a case for arguing that Africans should master the basic technology already available before embarking on nuclear grandiose.

But most important, however, is the fact that nuclear weapons--the ones already available--are undesirable. For all practical purposes, Africans are not only threatened by whatever nuclear arsenal the South Africans have but they are also threatened by what the Americans, the British, the French, the Russian and the Chinese have.

The OAU itself has been advocating disarmament and a ban on nuclear weapons worldwide. Mr Kodjo is fully aware of the efforts the OAU as an organization has made through passage of resolutions.

He is also aware of the statements made by individual OAU member states, opposing the existence of nuclear weapons any where on earth and in space. So what was he trying to accomplish with his statement?

We are not aware of what Mr Kodjo intends to do once he is no longer OAU secretary general, we doubt very much that he will be welcomed home in Togo. But if Mr Kodjo is planning to be some kind of a salesman for nuclear weapons in Africa, all we can say is au revoir.

CSO: 5100/44

NUCLEAR CAPABILITY, ASPIRATIONS DETAILED

Paris AFRICAN DEFENCE JOURNAL in English No 33, May 83 pp 52-54

[Text] **In October 1980, Mr. Chuba Okadigbo, a close adviser to President Shagari, made several declarations during his visit to the United States regarding his country's nuclear ambitions, announcing that Lagos was capable of building an atomic bomb should this become necessary. He stated that the necessary materials and technology could be obtained without difficulty, and that the major impetus behind a project of this sort was the fact that South Africa possessed nuclear weapons. It is thus worthwhile to take a closer look at Nigeria's veritable capabilities and objectives, and their consequences, beginning with the technical bases for such a claim.**

In order to become a candidate for the club of nuclear powers, a country must be a nation, possess a national territory, a population and a governing authority exercising its power in a very centralized manner: the decision to fire a nuclear weapon must not rest with several persons with equal powers. Moreover, the nation must possess an administrative and military hierarchy responding to the orders given it. The country must also have a certain wealth in terms of scientists, intellectuals and military personnel capable of setting out a policy for the use or non-use of nuclear weapons. Next an ability to finance the development of the weapon is necessary, along with the possibility of sustaining a substantial effort in modernizing its arsenal. This development in turn is based on three further requirements: possession of uranium, of experimental facilities, and of the ability to register credible results from the tests. Finally comes the motivation for nuclear deterrence — the perception of an aggressor, or of a victim. Having met all of these conditions, the country must also have the determination to become a nuclear power.

Capabilities: international political conditions in Nigeria

In terms of Nigeria's stability, unity and coherence, the country has recently gone through three major stages: the colonial period, with its hard to erase traces, the civil war and the unification. The three periods were marked by a series of fundamental problems that are above all due to the disparity between the three principal ethnic groups: the Haoussa fulani in the north, the great majority of whom are Muslims, the Yoruba in the southwest, animists, and the Ibo in the southeast, Christians.

The regions which initially followed the contours of the geographic zone in which each of the groups lived, led each of them to believe that it might itself form an independent national entity. During a second phase the number of these regions became high enough to break down separatist sentiments and to lead to the creation of the concept of a nation comprised of all three of the dominant ethnic groups. The problem arose, however, of the prorata representation of each state in function of the numerical strength of its population. Differences grew out of variations in the interpretation of the results of the census of the different populations, and there was discussion regarding the choice of an institutional model for the government, particularly between the «Westminster model» and the «Washington model». The country opted in 1977, when the military returned power to civilian authorities, for the American presidential system, which had proved the validity of a federation and a centralized power. The system has been functionning with very satisfactory results since October 1, 1979.

The objectives set for the administrative and military hierarchy in terms of responsiveness to government directives

have been satisfactorily fulfilled since the end of the Biafran conflict. The civilian administration has gradually extended its network to cover the entire country and, although a reasonably high amount of corruption continues to reign, an order from the top of the hierarchy is effectively passed down and implemented. The military administration, in spite of a reduction in its strengths to allow an increase in investment credits since 1979, has become sufficiently solid and disciplined since the end of the Biafran episode.

Nigeria's strength in terms of scientists, intellectuals and military personnel capable of defining a use or non-use policy for nuclear arms, on the other hand, is not at present extensive. With five universities open, the country has decided within the context of its Fourth Plan to build seven new technological universities. Higher education structures are gradually being developed with, in particular, the transformation of the Nigerian Defence Academy into an armed forces technical university, or with the founding of an equivalent of the IHEDN, the National Institute for Political and Strategic Studies, which graduated 40 students in 1980. Nevertheless, the shortage of teachers makes it necessary for the country to send students abroad at the end of their secondary schooling, both to Eastern bloc countries and institutions in Western nations, particularly in the area of nuclear research. Graduate students in this field, for example, receive training at the Massachussets Institute of Technology. In order to extend the benefits of this training, these MIT graduates then return to Nigeria to train other students on a research reactor soon to be delivered to Lagos University.

From a financial standpoint, Nigeria is using the objectives set by a series of five-year plans as a basis for using oil revenues to build up a powerful and independent industrial economy, a strategy that seems to be having a certain amount of success. Government expenditures show the scope of a state-directed economy. Between 1970 and 1981, the GNP was multiplied by 18, and the national budget by 11. Lagos is using both a lightening of the tax burden to spur economic activity and government directed investment planning to gradually direct what it hopes will become an economy with long term health. While defence expenditures have decreased following the demobilization carried out since 1979 by the civilian authorities, spending in the areas of research, science and technology has jumped from 154.6 million nairas in 1977 to 500 million in 1979, and to 515 million in 1980 (1981-82 figures are not available). It seems likely that Nigeria has included in this budget its nuclear development expenses, following the example of India, which counts its research and testing expenditures as part of its electrical program. This would seem to indicate that work has been in progress since 1980, when construction was begun on a nuclear power plant and on research facilities with potential military applications. With this in mind, it should be noted that while Lagos ratified the Nuclear Weapons Non-proliferation Treaty, it refused to sign the IAEA guarantee agreements. The program thus becomes credible, and is further strengthened by technology transfers from Brazil, France, Pakistan, India, Canada and Great Britain.

Nigeria will be able to obtain uranium from its own land beginning in 1984, and can already obtain it from Niger and Guinea since early 1983. The availability of testing grounds poses a problem since the Sahelian region that makes up 41 % of its territory is relatively densely populated and it will most likely be difficult for Nigerian authorities to carry out any thermonuclear testing in the area. However, this nation whose territory includes the Niger delta has extensive diplomatic influence in the Western Sahara region, and it is known that the phosphate in this region contains large quantities of uranium. Furthermore, above ground testing remains prohibited, and the opencast phosphate mines would make ideal receptacles.

The sum of all of these favorable material conditions enhances the possibility that credible results may be obtained within ten or fifteen years.

Foreign policy considerations

Nigeria's foreign policy revolves around three principal aspects. First comes its role in West Africa, followed by its role as black Africa's gendarme reinforced by its leading opposition to the apartheid regime in South Africa, and finally its relationship with the major powers within the context of decolonialization and non-alignment. The extent of the country's role in the affairs of the region are reflected in the part it played in the creation of the Economic Community of West African States, designed to link the French-speaking nations of the West African Economic Community (CEAO) to the English-speaking nations of the region. Lagos would like to see all traces of French colonialism disappear from the African continent, for relatively simple reasons. French cultural hegemony hinders its own, and France's continued economic strength is seen as detrimental to further economic penetration by Nigeria. Nigeria thus carried out intense lobbying for the creation of the ECOWAS, in order to increase its prestige in the region, particularly since its image had suffered considerably since the Biafran conflict. All unfavorable memories have not

been forgotten however and there are those who continue to suspect Nigeria of wishing to implement its own cultural economic and political hegemony Lagos though continues to see the ECOWAS as a step towards the creation of an African common market

The country's second role is that of black Africa's gendarme, a role that is strengthened by its strong opposition to South Africa's apartheid regime Lagos places a good deal of emphasis on black solidarity as it has grown out of the pan-African movement, and has been extremely active in the Organization of African Unity to reinforce its image of an influential partner in African affairs with regards to the various problems that have arisen since the organization was founded Nigeria is thought to favour the creation of an African armed force, and gave an initial example of this by sending a contingent to Chad But it clearly views the struggle against the Pretoria regime to be the catalyst that will unite African forces with one another With this in mind, as the only black African nation able to hope to develop a nuclear weapon in the reasonably near future and thus be able to bring the leverage of deterrence to weigh on its adversary, Nigeria is counting on becoming the leader on the African political front, or rather in black African affairs

This brings us to its third role An avid member of the non-aligned movement, Nigeria has not hesitated since its independence to enter into various alliances with the super powers, but has done so for its own benefit rather than through any sort of subservience Its goal is simple use the possession of a nuclear weapon as a vehicle for becoming a major power that represents the black nations of the world in an initial stage followed by its advent to the ranks of major powers on the world scene with no racial distinction Negritude is, after all, a tacit recognition of the difference between races

Next Nigeria's motivation and its consequences must be examined

Determination

Two opposing arguments have surfaced within the context of public debate in Nigeria on the doctrines governing use or non-use of a future nuclear weapon a continentalist position and a nationalist position For Professor Mazrui, a leading supporter of the continentalist position, African nations must disabuse themselves of the unrealistic concept of a nuclear-free zone in Africa His reasons are that Africa is a strategic continent with a central position that in spite of this has no role to play on the international scene This argument is twofold First of all, Professor Mazrui maintains that a continental nuclear strategy with the possession of nuclear weapons by African nations would increase the continent's prestige and political influence vis-a-vis the other power blocs thus bringing about a more favorable balance of power and even contributing to furthering the causes of world peace and stability

Secondly, a therory of a hemispheric hegemony of sorts would give Nigeria the role of leader in West Africa, and possibly in a later phase of leader of the entire African continent. The nuclear weaponry is thus felt to be a factor promoting integration in the long term and federation in the medium term Partisans of the nationalist point of view fear the precipitate nature of such thinking, which they attribute, moreover, to «ivory tower» intellectuals. They would rather see the nation avoid skipping essential stages and begin by acquiring a serious arsenal that would serve to protect their national territory, before extending the Nigerian nuclear umbrella to all of black Africa They would then, within the context of a well-developed and sustained policy, gradually extend Lagos' influence and alliances, thus at the same time extending their role of national protector. The end result of these gradual gains would be that South Africa will end up falling under the weight of its own internal opposition, the latter being aided by the financing of groups of pro-Nigerian agitators.

Whatever the position retained as Lagos' official policy on deterrence, the country's attitude towards disarmament shows that this change in position was not arrived at only recently

The evolution of the Nigerian position within the context of the international disarmament debate

Lagos early on strived to mark its presence and make its voice heard on the international scene. A certain accession to power was made possible through its admission to the United Nations General Assembly. Its non-aligned philosophy is clearly influenced by the position that it immediately took on disarmament

African nations, and Nigeria in particular have resolutely and consistently attempted to keep the Third World out of quarrels that oppose the two super-powers, taking the attitude of reasonable countries content to wait for conflicts to die down African nations had their honour affronted by the French tests at Reggane, and decided to play the worldwide disarmament card by declaring the African continent a nuclear-free zone. Nigeria took an active part in the decisions made on disarmament throughout the world, its positions seemingly based on solid beliefs. This zeal lasted until midway into the

1970s, a period that the UN had decreed the decade of disarmament. This fervor vanished with the recognition by the United Nations of South African's nuclear capability. The latter's nuclear program had been unofficially acknowledged since 1974 and was officially recognized when a group of experts was named by the Secretary General to aid in the establishment of a report on the matter, in conformity with a resolution passed by the Assembly in 1979. The group confirmed what had been strongly suspected.

Nigeria had believed that the super-powers would oppose this development of nuclear weapons-making capability, and that the acquisition of reactors would stop with their peaceful applications and would not be turned towards military ends. Initial confidence became silent suspicion and then outright defiance. A reading of the country's declarations at the UN is revealing: during its last speech on the subject in June of 1982, Nigeria vowed to arm itself with nuclear weapons if nothing was done.

Nigeria's role in a multi-polar world

The consequences of the combination of this capacity with avowed determination gives rise to three different notions. First, as to the influence of nuclear weapons on the African continent, their presence would in part have a destabilizing effect. Such a capability would upset the balance that has been established by provoking a re-alignment of existing alliances. It would initially act as a catalyst for some sort of federation, and in the long term for more comprehensive integration. In any event, if Libya succeeds in obtaining the secret of the bomb, the very real possibility of a limited nuclear conflict in a region of Africa will arise. On the other hand, it is highly unlikely that a conflict of this sort would break out between Lagos and Pretoria, first of all because the instigator of a nuclear conflict would find itself banished by the rest of the world, and secondly because the white South African minority lives in the midst of a black majority that would inevitably be hit in a nuclear attack, were Lagos to choose this strategy.

Secondly, as to the effects of a Nigerian nuclear deterrent on its relations with the super-powers, the latter will necessarily see their margin of maneuverability reduced in their attempts to avoid a limited nuclear conflict as well as the annihilation of their investments in a given region. This would be true even though they themselves could not be threatened directly because of their immense technological superiority, particularly in the field of anti-ballistic missiles.

Finally, unless a generalized nuclear war breaks out, direct forms of warfare will continue to be superseded by indirect types of conflicts centered on resources, on liberation movements financed by the new nuclear powers in order to avoid direct engagement, etc. But in any case, the risk remains that as these new powers acquire the ability to miniaturize nuclear weapons they may formulate doctrines different from those that presently reign in the northern hemisphere, thus authorizing limited battlefield strikes that would not necessarily lead to all-out nuclear attacks. Even this however, supposes a mastery of warfare that even the established powers have not yet been able to acquire.

Pierre Viaud

Doctor of Political Science and member of the International Institute for Strategic Studies of London

CSO: 5100/43

BRIEFS

SIAVONGA, SINAZONGWE URANIUM PROCESSING--Addressing Humanism seminar delegates representing Sinazongwe subboma at Maamba mine's golf club on Monday, Mr Simuchimba said that already, two firms from Japan and Italy, are busy prospecting for uranium in Siavonga and Sinazongwe areas respectively adding that so far, there are indications that the rock content of uranium is about 10% rich in content. [Excerpt] [Lusaka DAILY MAIL in English 18 May 83 p 5]

CSO: 5100/41

ACTIVITIES OF JUELICH NUCLEAR RESEARCH CENTER

Duesseldorf HANDELSBLATT in German 19 May 83 p 25

[Unattributed article: "Institute Constantly Transfers New Technologies to Private Enterprises--Research for Industry"]

[Text] Basic research and target-oriented energy technology are the equally important activity areas of the Juelich Nuclear Research Institute, Incorporated, with its approximately 4,400 employees of whom about 800 are scientists. It is the biggest among the dozen large-scale research institutions in the FRG.

An internationally known main effort in the work of the KFA [Nuclear Research Institute] is the development of an independent German engineering line of high-temperature reactors whose combustion chambers are charged with approximately tennis-ball-sized spherical fuel elements and which therefore are also called ball-pile reactors. Compared to the conventional nuclear power plants, they offer not only better handling in terms of safety engineering and a greater degree of fuel utilization coupled with less environmental pollution. Because of the enormous temperature level of its working gas, which is helium and which can be heated up to 950°C, they also open the way to a series of future-oriented applications which harmoniously combine nuclear and non-nuclear technology.

The key function of this development work on future high-temperature energy technology is signaled not only by such key words as coal gasification and electric current, processed steam, district heat for households and industry. In general, the high-carat heat of these reactors can be used for converting such ballast-rich and therefore also more or less dirty solid fossil raw materials as hard coal and brown coal into clean liquid or gaseous energy sources which can be stored, distributed, and used in existing supply systems.

Investigations on the exploration and procurement of fossil fuels and on the environmental effects of their utilization are closely connected with this work. In the field of geochemistry it was thus possible to obtain basic knowledge and to use it for the improvement of petroleum exploration.

Looking to the more distant future, scientists and engineers are working on the implementation of controlled nuclear fusion whereby the utilization of the "Textor" Tokamak plant is emphasized in the KFA.

Basic requirements are being created in the KFA for tomorrow's technologies also in the field of solid-body and surface research and in nuclear physics and nuclear chemistry. Here, the most modern methods are being used to explore the innermost properties of solid bodies in the broadest sense which promises both surprisingly new applications and also the goal-oriented manufacture of novel materials. One way toward further knowledge here is opened up by minimum-temperature technology in which KFA was able to report a world record to the effect that it came close to the absolute zero point--which is at -273.16°C (and which is unobtainable as a matter of principle)--to within 0.000038 degrees.

Another way consists in exploring the microcosm inside matter with neutrons acting as probing projectiles. For this purpose, Juelich is building, as its latest big equipment unit, a spallation neutron source whose peak flow of no less than 70 million billion neutrons per second and per square centimeter will overshadow everything done so far.

KFA however is also emphasizing environmental research. This, on the one hand, involves the exploration of biogeochemical substance cycles in earth, water, air, vegetation, as well as the route taken by harmful substances through the food chains all the way to man, but, on the other hand, also the task of so utilizing the chemicals employed for plant cultivation and animal husbandry that only the minimum possible side effects will be associated with optimum possible desirous effects.

The institute is also investigating the gene-altering effect of radiation and chemicals on the nucleic acids of living organisms, the spread of radioactive substances in the environment, and the type of routes they covered in the process. In addition there is a continuing improvement of analysis methods as well as the documentation of harmful substance dissemination over long intervals of time in the new environmental sample bank.

New methods of health care, therapy, and rehabilitation are being developed in the life-sciences sector of KFA. By using short-lived radionuclides, it is possible, for example, to develop extensively pain-free, fast, and precise diagnosis methods for medicine, and to make metabolism processes transparent for biology. The great metabolism performances of micro-organisms moreover make it possible to convert certain waste products into human food or animal fodder or other worthwhile substances.

All of this work at KFA is being carried out both domestically and internationally in close cooperation with colleges and other research institutions but also with industry whose central contact point at KFA is the technology transfer office. KFA is charting a new way of company policy for technology transfer as supplier of special techniques and methods for technology-oriented enterprise establishment projects. Its knowledge in the field of exploration of hydrocarbons for example led to the founding of a "Company for Integrated Exploration Systems."

The object of this enterprise--which works according to purely scientific viewpoints and which does not get any government subsidies--is the application

and development of the most modern scientific methods for the exploration of petroleum and natural gas as well as other raw materials or energy sources. In particular, they are using the concept of integrated basin studies which is founded on computer-assisted simulation models. This again is a high-technology undertaking which was developed and tested in practical terms at the institute by Professor Welte. It permits a considerably better determination and location of the hydrocarbon potential in the sedimentary basin than conventional methods. This new technology can be applied without any additional investments and with a small personnel force.

A joint KFA-and-industry study group, established under the Aachen Chamber of Industry and Commerce, helps promote the dialogue and cooperation between the two partners and to remove existing obstacles. The Juelich KFA, together with the Rhenish-Westphalian Technical College at Aachen which is just 20 km away, represents a technical-scientic infrastructure, such as it can be found worldwide at most only in ten places; the important thing in the future is to use this outstanding location factor for technologically oriented enterprises in the research and development sector as well as in product and process development through "technology transfer."

Today already, highly reputable enterprises are located in the Juelich area which make use of the knowhow of nuclear technology in other industrial application fields. The range of products supplied by these enterprises extends fromfilters for clean-room technology via structural components made of coal-fiber composite materials, all the way to electronic measurement instruments.

The FRG's scientific-technological cooperation with Brazil, India, Yugoslavia, Egypt, Greece, and Indonesia is being handled by the International Office of KFA.

Further information may be obtained from Dipl.-Ing. Siegfried A. Weinhold, Kernforschungsanlage Juelich, Postfach 1913, D-5170, Juelich 1, phone: 02461/614661

5058
CSO: 5100/2607

EDF OFFICIAL ON NUCLEAR PROGRAM'S STATUS

Rome NOTIZARIO DELL'ENEA (supplement to N°2) in French Feb 83 pp 42-47

[Address by R. Carle, Equipment Director, Electricite de France]

[Text] Since 1973, France has put forth considerable effort aimed at reducing its energy dependency: energy savings, replacing medium distillates with coal, particularly to fire power plants, moving into a major hydroelectric development program, developing renewable energy sources -- and a nuclear program.

Why does France still have a nuclear program when a lot of countries have halted or delayed theirs?

France moved into the 1973 crisis with an energy dependence rate of 75 percent. Since then, it has stepped up its efforts:

-- efforts at engergy conservation, first of all: our overall consumption of energy is practically stable today;

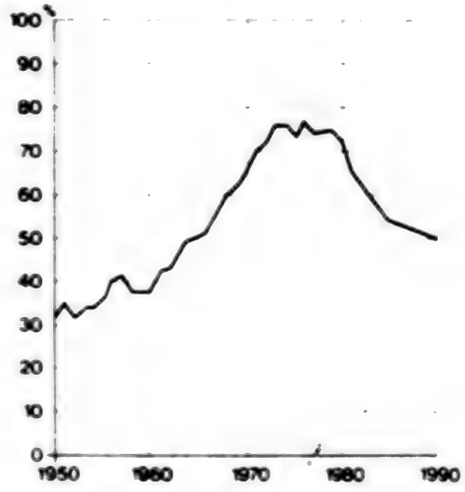
-- resumption of development of our hydroelectric resources: we are currently building 4,000 MW in hydroelectric plant, but aside from some possible tidal projects, this should level off at around 75 billion kwh per year;

-- developing renewable energy sources: we can reasonably anticipate these to supply around 50 percent of our total requirements by the end of this century;

-- lastly, and above all, replacing oil with coal and nuclear.

The objectives proposed by the government and approved by Parliament in October 1981 call for just about equal shares by 1990 for gasoline on the one hand and coal and gas on the other, and then to nuclear; renewable sources (including water power) will provide the remaining 10 percent.

France's Energy
Dependency Rate



Solar	1.5 Mtep
Geothermal	1-1.5 Mtep
Biomass	7-10.5 Mtep
TOTAL:	10-14 Mtep

These objectives assume a major effort in the shift back to coal, particularly in industry. They reflect the transition in nuclear energy from the few percentage-points it provided as of the end of the Seventies to the considerable share of 27 percent.

On this second score, we have already covered a good bit of the road, since in 1981 nuclear energy provided 11 percent of our total energy requirements.

Nuclear power is an industrial reality in France today, and I should like, quickly. to give you some of the figures.

I shall then try to show you the outlook for the future, both for the present generation of power plants, and in the area of the fast breeders.

Nuclear Energy: Today's Industrial Reality

Nobody can seriously challenge it any more: with 22 900-MW units on line now of the 34 that will complete the 900-series nuclear plants in 1981 accounted for close to 40 percent of France's total electric generation, or roughly 100 Twh. That is the equivalent of all electric power generated in France in 1965. Operations in these plants now represent something like 50 reactor-years. Twelve more 900-MW sections and 18 1300-MW units are now under construction. Paluel I, the first unit in the 1300 level, will come on line in 1983. Along with this, France has provided itself with a coordinated system of tools which allow it to handle the entire combustion cycle, from the uranium mine to waste treatment, via fuel enrichment, fuel manufacture, and reprocessing.

The key word in these achievements is the continuity of the effort. Technical continuity, by means of seeking maximum standardization without thereby foregoing all advances or responding to additional requirements in the area of safety and reliability. Industrial and commercial continuity was achieved by awarding cluster contracts covering eight or 12 successive units.

This enabled us to acquire an industrial tool: and so a new industry was born, a highly skilled industry which directly or indirectly employs close to 200,000 people and assures the retention of four to five times as many jobs. Plants have been built to turn out specific components, with a capacity to match four to five 1300-MW units per year. A particularly strict quality control system has been adopted: affecting the behavior of very large corporations, at all levels of sub-processing, its fallout has profoundly changed an entire sector of French industry in the direction of stricter standards and better quality.

THE FRENCH NUCLEAR POWER PROGRAM

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31 Sections are now operating on the French system:
- 6 graphite-gas (UNGG design)
- 1 heavy-water-gas reactor
- 1 fast breeder reactor
- 1 pressurized water/300 MWe reactor
- 22 pressurized water/900-MWe reactors

for a total power output of 22,400 MWe net, close to 14 percent of the world total.

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21 nuclear power units are under construction (including 1982 and 1983 commitments):

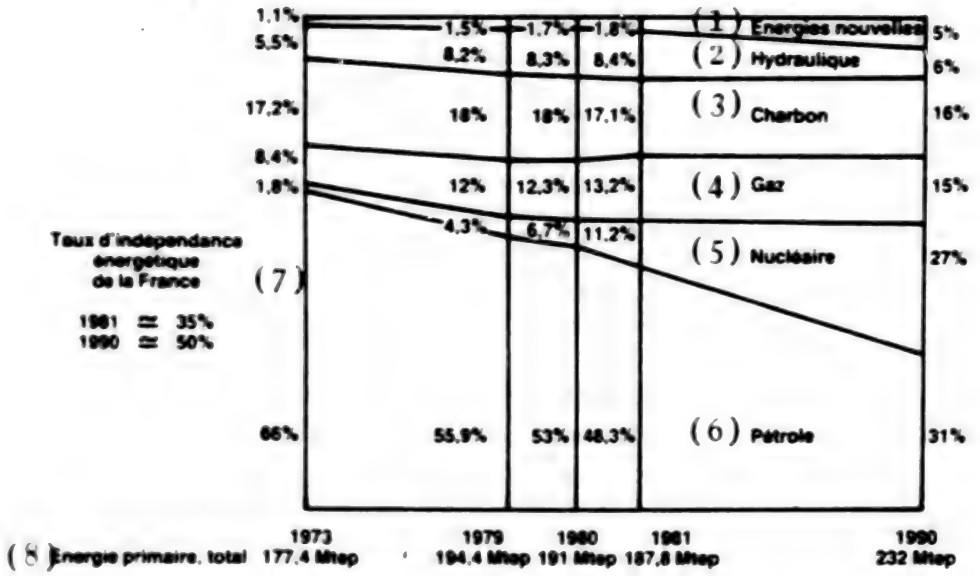
- 12 Pressurized water/900 MWe reactors
- 18 Pressurized water/1300 MWe reactors
- 1 fast breeder reactor/1200 MWe,

for a total net power output of 34,000 MWe.

Even as the French industry was building its strength, it was casting about for ways to achieve autonomy; early additions to the licensing agreements between Westinghouse and Framatome, which were renewed in 1972, were the 1975 research and development agreements involving the CEA, EdF, Framatome, and Westinghouse. Then in 1981, a year ahead of time, the licensing agreements were revised to make room for partnership agreements. Now, with the new 1300-Mw sections, we have a French water-cooled reactor which is following its own development plan.

Where do we stand in the effort to cut lead-times and costs? No doubt, in the course of this conference we shall hear a lot of countries reporting catastrophic drift in these areas. It needs

FRANCE'S ENERGY REDEPLOYMENT
FROM 1980 TO 1990



Key:

(1) New energy sources
(2) Hydroelectric
(3) Coal
(4) Gas
(5) Nuclear
(6) Oil
(7) France's energy dependency level
(8) Primary energy, total in Mtep

to be said, loud and clear, that wherever projects are subject to unforeseeable procedures throughout the entire period of realization without anyone's being able to predict either the length or the outcome of those procedures, there is no point even in talking about controlling lead-times or costs, nor is there any point in talking about industry-wide approaches. Fortunately, this is not the case in France, thanks to standardization and to clear and precise legislation and doctrine on reliability.

Construction lead-times actually observed have met our initial objectives: while Fessenheim I was completed in 78 months, the units brought on line in 1981 or 1982 were completed in periods on the order of 60 months, and today we can count -- barring startup trouble on the new series or an unforeseen incident, on a lead-time of 5 years for a 900-MW unit or 6 years for a 1300-MW unit.

When it comes to costs, bear in mind that of course the kwh price installed has risen by something like 50 percent since Fessenheim. What has happened is that we have integrated into operations on the later steps all the new constraints that required development of safety and radiation-protection rules, and that as we went along we got a better grip on operational imperatives. Today, this particular cost seems to have more or less stabilized.

With this cost reduction, nuclear power is -- under the conditions prevailing in France -- 50-percent cheaper than coal-generated power and three times cheaper than oil-generated power (on this point I refer you to the very specific report Messers Baumier and Bergougnoux gave you).

Another paper, delivered by Mr Mira, lists in great detail every incident we have experienced. We can only be amazed that some people are amazed by them. Quite probably, they have not had experience in such complex installations as conventional power stations. Coping with these incidents and avoiding their recurrence is the job of power generating plant operators. Standardization, by letting us use experience with one unit and apply it to all other units, is a powerful factor for progress in this domain. The record we have chalked up thus far, over those 50 reactor-years I mentionned just now, show us that our nuclear installations are maintaining availability performance comparable in every way with those of the other generating plants, and better than those used for economic calculations.

There you have the elements that make a bottom line pleasant reading. Not only in France, but in a good many other countries, nuclear energy has come of age.

What, then, are its real drawbacks? Personally, I see three.

The first is the investment cost, which ties up capital sums which are the more important in that the lead-times are so long. In the

COMPLETION STATUS OF THE FRENCH

PRESSURIZED WATER REACTOR PROGRAM

900-MW Series	* On-line as of 1/1/82	1300 MW series	On-line as of 1/1/82
Start of series: Total 5400 MW		P4: Total 10340 MW	
Fessenheim 880 MW x 2		* Paluel ;290 MW x 4	
Bugey 920 MW x 2 and 900 MW x 2		* St-Alban 1300 MW x 2	
		Flamanville 1290 MW x 2	
CP1: total 16320 MW		P4: total 12700 MW	
Tricastin 915 MW x 4		* Cattenom 1265 MW x 3	
Gravelines B 910 MW x 4		* Belleville 1275 MW x 2	
Campierre 890 MW x 4		* Nogent 1265 MW x 2	
Le Blayais 1910 MW		* Penly 1 1270 MW	
Le Blayais 910 MW x 3		Golfech 1 1270 MW	
Gravelines C 910 MW x 2		Chooz B 1 1270 MW	
CP2: Total 8760 MW			
St-Laurent B 910 MW x 2			
Chinon B 870 MW x 4			
Cruas 880 MW x 4			

- Pressurized water reactors on-line as of 1/1/1982 (21 x 900): 17170 MW
- Plants under construction (12 x 900 and 13 x 1300): 27700 MW
- Plants in preparation stages (1982/83 program) (1 x 900 and 5 x 1300): 7400 MW
- Electric power generated in France in 1981: 264 TWh, of which nuclear plants delivered 99.5 TWh (37%).

current tight money market, the power producer feels this drawback very keenly indeed: the financing charges EdF must bear these days is, alas! poignantly illustrative of this point. It is true, however, that this particular burden is merely the opposite face of the beneficial transfer brought about by nuclear power between payment in hard currency for import fuel and buying our plant equipment from French companies.

Second drawback: technical fragility in a radioactive environment, or, to put it another way, the complexity of intervention in plants in service. We must in all candor admit, in the wake of the complete inspections conducted over the course of the past few years, that the number of hours of work required was higher than we expected. Here again, though, the accumulated experience with the standardized units will prove invaluable, and we have already been able to cut down the level of man-rem to which personnel have been exposed during the annual shutdowns. The fact remains that the high cost of repairs will continue to make it vital in the nuclear power field to keep looking for the best possible quality. Skill, continuity, and accumulated experience should enable us to increase the availability of nuclear plants beyond what we have today, since availability and safety are so closely intertwined. Installation of operating simulators, improved maintenance procedures, using inert mockups when necessary, combine to form the normal follow-up to the efforts already made in design and construction to achieve organized quality. Of course, all this is going to cost a lot of money, but simple economic arithmetic shows that replacing oil-fired generation with nuclear, even for a few hours at a time, is already repaying a lot of the effort we have put into reliability.

From 1975 to 1985, we shall have hired more than 18,000 people at all levels, and we have established extensive training and skill-enhancement facilities. Here again, standardization enables us to make optimum use of such "heavy" assets as simulators that faithfully reproduce our standard control rooms and the situations their operators may encounter. Two simulators are already in operation at Bugey. Four more will be coming on line by 1984, two of which are designed to match the 1300-MW units. In addition, we have developed operation simulators as well as a centralized computer-assisted instruction program, to which all plants will have direct access.

That brings us to the third handicap: nuclear power is not readily accepted by the general public. That point has already been the target for voluminous comment, and I shall not go into any lengthy analysis of it. I am personally convinced that as many nuclear plants quietly come on line, public opinion has begun, at least in France, to see the excessive nature of alarmist propaganda for what it is. While the protest reached its peak in France in 1977, when construction began on Creys-Manville, polls taken since then show a very clear trend in the other direction.

ON-LINE TARGET DATES

(1) Année de couplage	(2) Nombre de tranches	(3) Type	(4) Puissance nette continue en MWe	
1982	2	(5) PWR 900	1740	
1983	2	PWR 900	1820	
1984	3	PWR 900	2640	6420
	2	PWR 1300	2580	
	1	(6) Surgénérateur	1200	
1985	2	PWR 900	1790	4380
	2	PWR 1300	2590	
1986	2	PWR 900	1780	9490
	6	PWR 1300	7710	
1987	1	PWR 900	870	4695
	3	PWR 1300	3825	
1988	2	PWR 1300	2545	
1989	3	PWR 1300	3840	
Total	31		#34 900 MWe	

KEY:

(1) Year on-line
(2) Number of units
(3) Type
(4) Net continuous power in MWe
(5) Pressurized water reactor (900 series)
(6) Breeder reactor

Of course, EdF has spared no effort in the area of public information, sending out thousands of pamphlets and brochures, and welcoming several hundred thousand visitors to its plants every year (300,000 in 1981). That kind of information, necessary though it was, proved inadequate because it was perhaps too one-sided: every citizen must be able, if he so desires, not only to get information, but to make his concerns known, to have a voice in decision-making, and to share in the implementation of such decisions.

This is the reason why we have striven to make progress along two lines:

-- on the one hand, when the initial decision was made to adopt our energy independence plan -- approved by the National Assembly in October 1981 -- and to apply it to all planning as of the adoption of the project. The preliminary consideration of the request for a finding of public interest -- which, in France, is the first step in the implementation of a major plan -- has been steadily improved since 1975 in the direction of heightened participation by the people and their elected representatives in the decision-making process. Local commissions are now regularly constituted to monitor construction and subsequent operation of each plant. And just recently a circular from the Prime Minister's Office added another stone to this structure;

-- on the other hand, all during the process of construction and operation , the idea is to make every plant the "personal business" of the region where it is located, rather than a foreign body whose presence would trigger rejection reactions. To this end, EdF has developed a set of arrangements known generically as "Major Construction Procedures." They make it possible:

-- to plan for and organize the local reception of the construction workers and their families;

-- to encourage utilization of the manpower and business resources of the host region;

-- and lastly to cushion any difficulties that may arise in the area of employment from completion of construction.

In all, thanks to these measures, it is no exaggeration to say that every one of our power plants has become a magnet for regional development and is already widely perceived as such.

That's the shape of the present. What does the future hold for us?

Continuation of the Nuclear Program

Let is be said clearly right at the start that /the French nuclear program is continuing/, first through starts on installations under construction, and second through new investments in connection with the two directions of the quantitative water-cooled plants and the demonstration program for breeder reactors

It is true that the annual audit by the French government at the end of 1981 led to a marked slowdown in the pace of annual commitments. That pace, already set for 1982 and 1983 at three units per year, should be somewhere between two and three per year. The reasons for this are obvious. Up to now, the idea has been to replace the greatest possible amount of oil; that task has, for all practical purpose, been achieved as of now; beginning in 1985, oil will power only a very small percentage of our generating capacity. The idea now is to keep a close eye on consumption growth (which is not all that easy to do, since it involves forecasts projected close to 10 years into the future); it is clear in any case that right now the decline in consumption in Western economies and the quest for less energy-intensive forms of growth are being translated into a slower pace of growth in consumption.

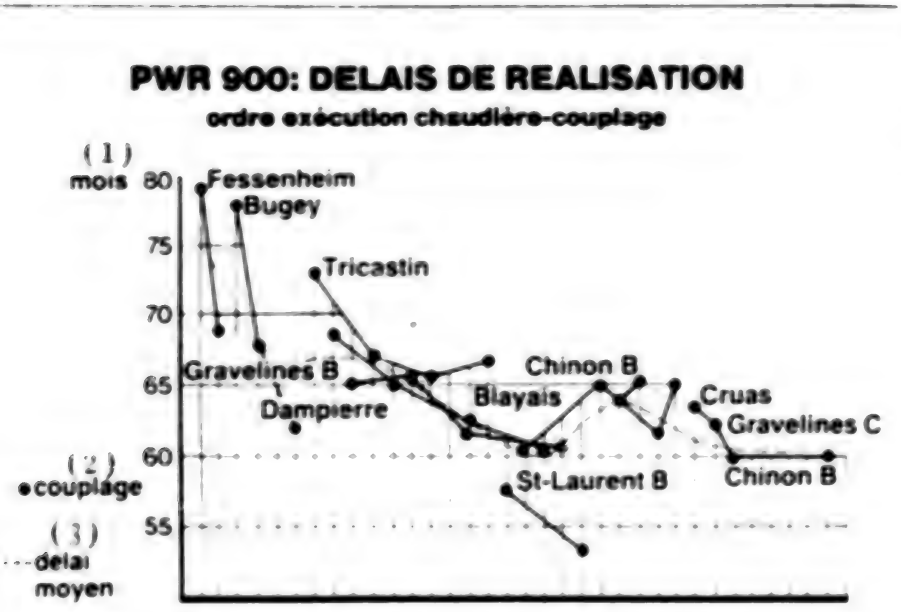
And so it was quite predictable that the nuclear program would slow down; maybe the economic recession accentuates that slowdown, which unquestionably poses some industrial problems. It would be a good idea to find out whether these excess capacities can be used to develop the export market.

It would also be a good idea to look into the future of a product that meets the most stringent requirements of reliability and safety, and that has made full use of the accumulated experience with French and foreign plants. That is the thrust of the adoption in France of a new 1300-MWe series, known as N4, a series whose first unit should be started during the 1983 program.

This product is designed, on the one hand, to bring a better selling price, thanks to a slight increase in its power rating and to several better-optimized components, and, on the other, to incorporate recent improvements in the areas of electronics, computer performance, or robotics to upgrade the man-machine interface or radiation protection for personnel.

We shall be putting this product, which must be viewed in the context of continuity with our past technical experience, into service between 1990 and 1995, and we hope that it will provide a lasting response to the requirements of that decade. Isn't that yet another example of the nuclear challenge?

Lastly, I'd like to say a few words about breeder reactors, a road we have been travelling for more than 20 years now. Of

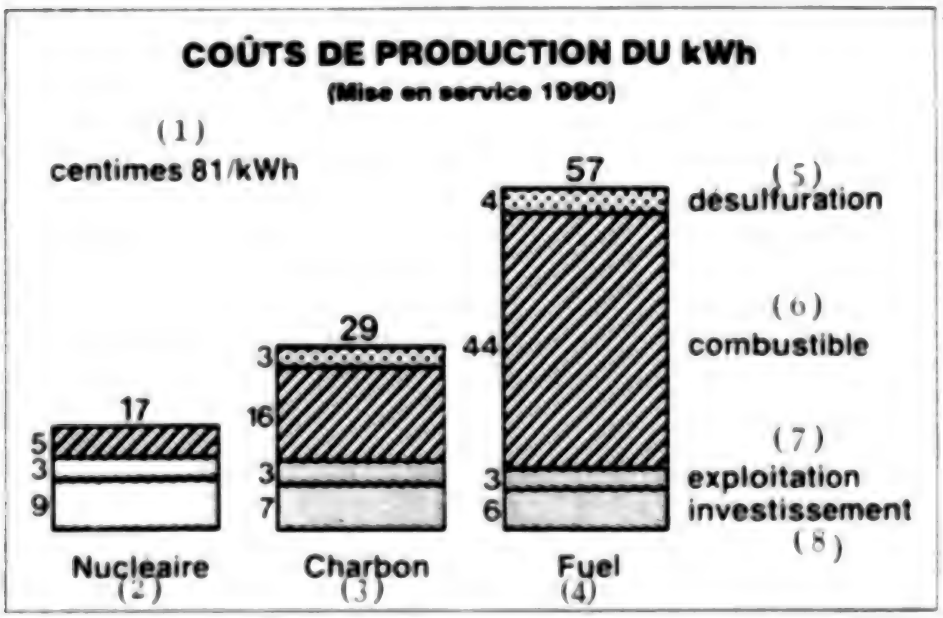


900-SERIES PRW LEAD-TIMES (order to completion to startup)

KEY:

(1) Months
(2) Plant startup
(3) Mean lead-time

PRODUCTION COSTS PER KWH
(Startup 1990)



KEY:

(1) in 1981 centimes/kwh
(2) Nuclear
(3) Coal
(4) Oil
(5) Sulphur removal
(6) Fuel
(7) Operating
(8) Investment

course the status of nuclear programs worldwide and of available sources of uranium make the breeders less urgent a need than we thought they would be a few years back. We are nevertheless still convinced that we shall be needing this system in the future in order to cope with dwindling supplies of uranium or speculation in its pricing, and that this system will constitute a natural complement to our first-generation plants. Is an alternative energy source possible by the time we enter the 21st century? It may well be prudent to work on that, but right now no alternative has reached the same stage of industrial use and we have no right to turn back from so promising a road.

The Superphenix plant is moving ahead on a multinational basis. This 12000-MWe plant should come on line in 1984, and prove once and for all the reliability of this design, following the highly satisfactory performance of the Phenix.

What will our target be for the next phase? On one hand, to demonstrate that the cost per nuclear kilowatt hour generated by a breeder can come close to that for a pressurized-water KWh as the breeder goes into full production, and on the other to stabilize the fuel-cycle cost by building an industrial-scale plant for reprocessing the fast fuel. It is in this spirit that the CEA and EdF intend to propose to the French government a plan, beginning in 1986, for completion of a new phase in breeder reactor development.

* * *

No, the nuclear adventure is not over: it is just beginning. The breeders are, if we handle them right, one way to a lasting solution to the problem of the world's hunger for energy. Isn't that a goal which the international community could helpfully adopt, so as to prove to everyone their reliability, their safety, and their economy?

That also assumes that we demonstrate on the nuclear plants in operation right now that they are indeed reliable, safe, and economically sound. The results achieved in France -- and in many other countries -- show that it is possible. This is what it will take to show our children, and at last to make them believe that nuclear energy is simply another way to generate electricity for the good of us all.

9182

CSO: 5100/2602

ASEA FIRM LOOKING TO FOREIGN MARKETS IN DEVELOPMENT WORK

Stockholm SVENSKA DAGBLADET in Swedish 20 May 83 p 22

[Article by Sophie Petzell: "Producing a Nuclear Reactor for the Markets of the 1990's"]

[Text] With an eye for both the international and domestic market, the Asea Atom firm is working on a new reactor. Along with this, the marketing of the Secure reactor is getting under way abroad. Asea's managing director, Lars Halle, told the SVENSKA DAGBLADET that the new reactor can be marketed in the 1990's if all goes well and development lives up to its promise.

The reactor is a light-water type and failures cause it automatically to shut down and cool the fuel core. Lars Halle explained that the new system is based on the development work that Asea did for its small nuclear heating plant, Secure.

Asea Atom, a wholly-owned affiliate of Asea, is working with a construction concept that has been dubbed Pius, an acronym for Process-Inherent Ultimate Safety.

In Latin, pius means devout or meek, and Lars Halle is going all out to emphasize the inherent gentleness of the new reactor. However, he will not promise that Pius will ever be commercially available.

A Low Profile

"We haven't gotten far enough along with the development work," he said, wishing to maintain a low profile for the time being.

Nonetheless, American trade journals have been paying attention to Pius and report that the Tennessee Valley Authority, contemplating a future installation, is following the work with very great interest.

Lars Halle said that future Pius plants, if they ever materialize, will be small, with a capacity of around 500 megawatts, compared with a megawatt capacity of 900 to 1,000 for the three Forsmark reactors.

Pius will be relatively economical. The reactor can be built quickly and requires consideraly fewer moving parts than do today's reactors. The safety system is based on the system being adapted by Asea Atom for use in a Secure heating plant. There is as yet no Secure reactor in operation, but a test rig will be built shortly in Vasteras.

Not Loaded

Because of the referendum on nuclear power, the reactor cannot be loaded with fuel. In lieu of that, it will stimulate the conditions existing in nuclear power plant operations by means of electrical heating.

"It would be nice if we could show a real demonstration plant when we begin our export drive," said Lars Halle.

But he still sees good export opportunities. Asea Atom has just signed an agreement with Vattenfall, a Finnish company, for a 1-year study of the possibilities of using Secure for a remote-heating plant in Helsinki.

Cooperation is also under way with companies and authorities in South Korea for a possible Secure heating plant in Seoul. Countries in Eastern Europe, too, have indicated interest, especially Czechoslovakia.

A Safe Reactor

Spokesmen at Asea Atom assert that Secure is so safe that it can be built in the vicinity of larger population areas. It can be shut down and cooled without help of electrical or mechanical equipment. The reactor tank and steam generators of the pressurized-water reactor are lowered into a basin filled with water containing boron. The reactor water and the boron-containing water remain separated during normal operation due to the simple fact that the hot reactor water and the cold basin water have unlike densities.

Should anything go wrong, the balance is disrupted and the boron water flows in, causing the reactor to cool down and to shut off.

"Moreover, spent fuel can be kept in the tank," states Lars Halle, "and therefore there is no need for frequent and risky transport." He claims that fuel can be stored in the tank safely.

Complicated

The Secure reactor has a relatively low operating temperature and it is technically complicated to transfer its concept to the new Pius reactor. Reactors which generate electricity require appreciably higher temperatures than do heat-producing reactors.

The people at Asea are apparently quite confident about executing the Pius project and possibly marketing it eventually, even though they continuously stress that Pius is in an early stage of development.

Lars Halle beleives that Pius can be marketed as early as the 1990's. Since the reactor is easy to operate and demands little advanced knowledge on the part of the operators, the developing countries could be a potential market. It is possible that there will be Swedish buyers as well.

Possible Alternatives

"When the time comes to review the nuclear power decision, both Pius and Secure will be possible alternatives for Sweden too," predicted Lars Halle.

This review, he believes, will come when we have to make a decision on prospective coal-steam power plants. The coal-steam power plants are presently regarded as future alternatives to the current nuclear power plants.

Nuclear power is, claims Lars Halle, considerably more friendly to the environment than is coal combustion. Pius could also offer far greater economy than can the coal-burning plants, in addition to having greatly improved safety in comparison with today's nuclear reactors.

Alternatives

He considers Secure to be an alternative to other heat-generating plants. The construction of a nuclear heating plant is significantly more costly than that of oil or coal burning plants, but the costs for heat are twice as great with oil and half again as great with coal.

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BRIEFS

OLDEST REACTOR IN GOOD CONDITION--Sweden's oldest reactor, Oskarshamn 1, seems to be holding up better than the newer installations. No cracks were found during the recently completed check of welding seams in the reactor. The reactor is supposed to go on line again in mid-June. The state Nuclear Power Inspection ordered that the pipes in the Oskarshamn reactor be checked during this year's shutdown after pipe leaks had been discovered in the Ringhals reactor last winter. Ringhals 1 is the same design as Oskarshamn 1. Inspections revealed that Ringhals 1 was subject to the same defects that have caused problems in a number of foreign reactors, defects caused by what is called intergranular stress corrosion. The owner, Oskarshamn Kraftgrupp [Oskarshamn Power Consortium], reports that the investigation has been completed in Oskarshamn 1 and that no cracks were found. The country's oldest reactor has been in operation for 11 years. Since it went on line in 1972, the reactor has generated 29,631 million kilowatts. [Text] [Stockholm DAGENS NYHETER in Swedish 26 May 83 p 12] 9992

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